NEC

MOS FIELD EFFECT TRANSISTOR

μPA1857

N-CHANNEL MOS FIELD EFFECT TRANSISTOR FOR SWITCHING

DESCRIPTION

The μPA1857 features a low on-state resistance and excellent switching characteristics, and is suitable for applications such as power switch of portable machine and so on.

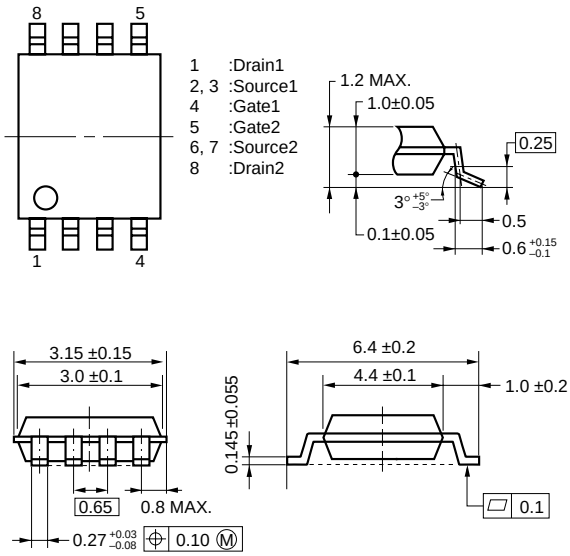
FEATURES

- Low on-state resistance
  $R_{DS(on)1}$ = 67.0 mΩ MAX. (V_{GS} = 10 V, I_D = 2.0 A)
  $R_{DS(on)2}$ = 86.0 mΩ MAX. (V_{GS} = 4.5 V, I_D = 2.0 A)
  $R_{DS(on)3}$ = 95.0 mΩ MAX. (V_{GS} = 4.0 V, I_D = 2.0 A)
- Low C_{iss} C_{iss} = 580 pF TYP.
- Built-in G-S protection diode against ESD

ORDERING INFORMATION

PART NUMBER	PACKAGE
μPA1857GR-9JG	Power TSSOP8

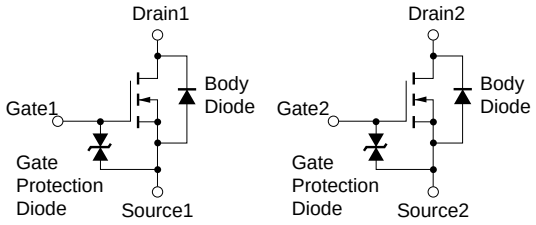
PACKAGE DRAWING (Unit: mm)



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	60	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	±20	V
Drain Current (DC) (T_A = 25°C)	$I_{D(DC)}$	±3.8	A
Drain Current (pulse) Note1	$I_{D(pulse)}$	±15.2	A
Total Power Dissipation (1unit) Note2	P_{T1}	1.0	W
Total Power Dissipation (2unit) Note2	P_{T2}	1.7	W
Channel Temperature	T_{ch}	150	°C
Storage Temperature	T_{stg}	–55 to +150	°C
Single Avalanche Current Note3	I_{AS}	3.8	A
Single Avalanche Energy Note3	E_{AS}	33	mJ

EQUIVALENT CIRCUIT



Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. T_A = 25°C Mounted on ceramic substrate of 50 cm^2 x 1.1 mm

3. Starting T_{ch} = 25°C, V_{DD} = 30 V, R_G = 25 Ω, V_{GS} = 20 → 0 V

Remark The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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The mark ★ shows major revised points.

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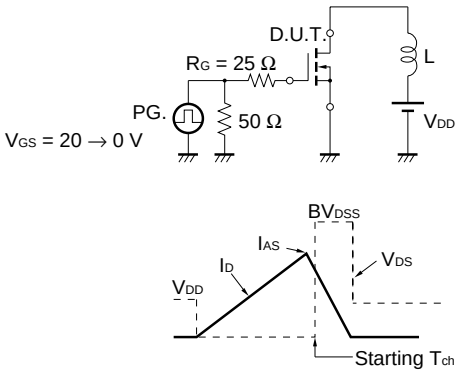
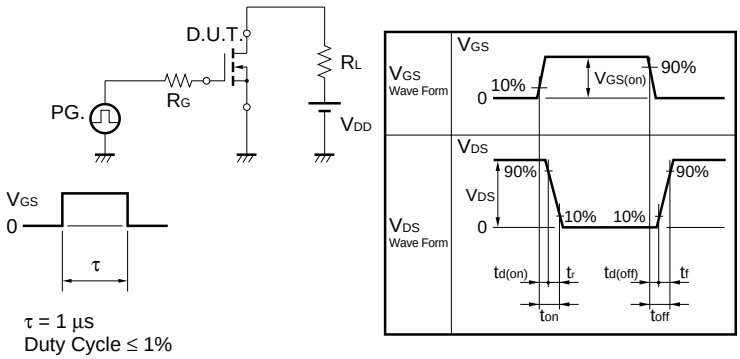
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V			10	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±10	μA
Gate Cut-off Voltage	$V_{GS(off)}$	V_{DS} = 10 V, I_D = 1 mA	1.5	2.0	2.5	V
Forward Transfer Admittance	$\|y_{fs}\|$	V_{DS} = 10 V, I_D = 2.0 A	2.5	5.4		S
Drain to Source On-state Resistance	$R_{DS(on)1}$	V_{GS} = 10 V, I_D = 2.0 A		53	67.0	mΩ
	$R_{DS(on)2}$	V_{GS} = 4.5 V, I_D = 2.0 A		64	86.0	mΩ
	$R_{DS(on)3}$	V_{GS} = 4.0 V, I_D = 2.0 A		71	95.0	mΩ
Input Capacitance	C_{iss}	V_{DS} = 10 V		580		pF
Output Capacitance	C_{oss}	V_{GS} = 0 V		100		pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		50		pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 30 V, I_D = 2.0 A		10		ns
Rise Time	t_r	V_{GS} = 10 V		9		ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 6 Ω		32		ns
Fall Time	t_f			4		ns
Total Gate Charge	Q_G	V_{DD} = 48 V		12		nC
Gate to Source Charge	Q_{GS}	V_{GS} = 10 V		2		nC
Gate to Drain Charge	Q_{GD}	I_D = 3.8 A		3		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	I_F = 3.8 A, V_{GS} = 0 V		0.80		V
Reverse Recovery Time	t_{rr}	I_F = 3.8 A, V_{GS} = 0 V		33		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		58		nC

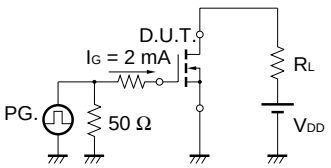
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

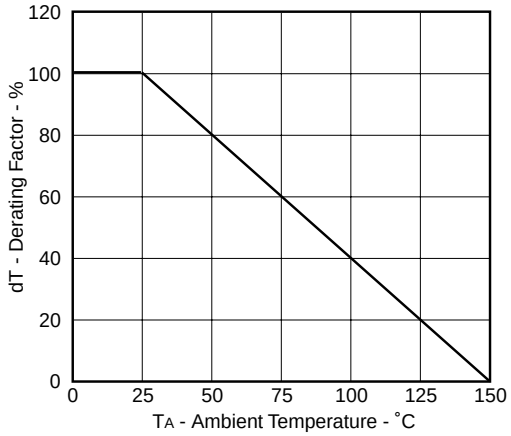


TEST CIRCUIT 3 GATE CHARGE

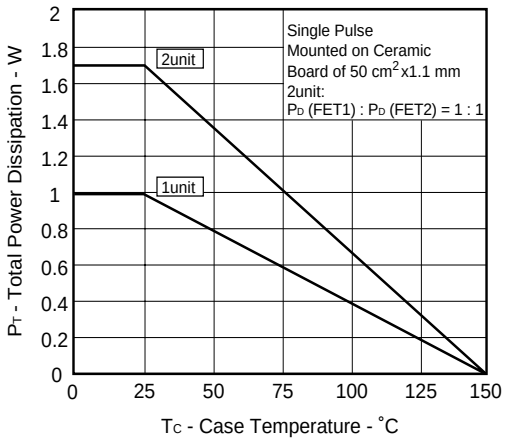


TYPICAL CHARACTERISTICS (T_A = 25°C)

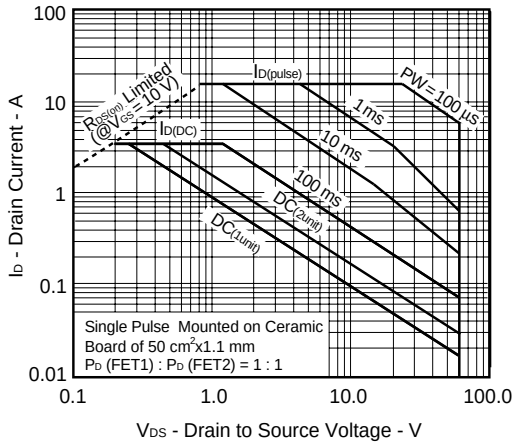
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



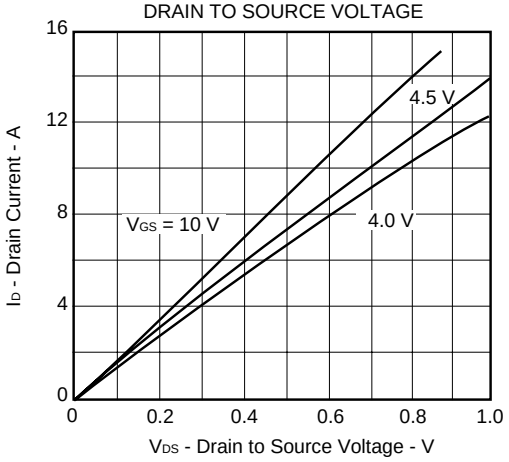
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



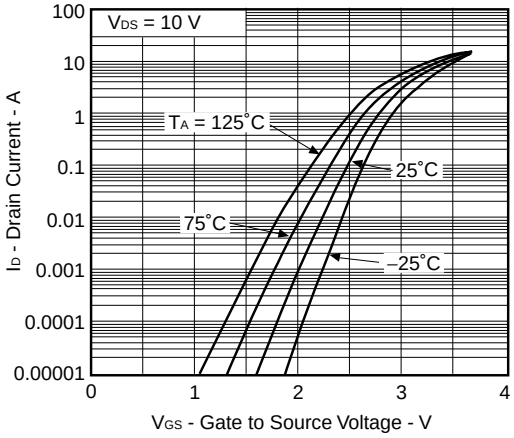
★ FORWARD BIAS SAFE OPERATING AREA



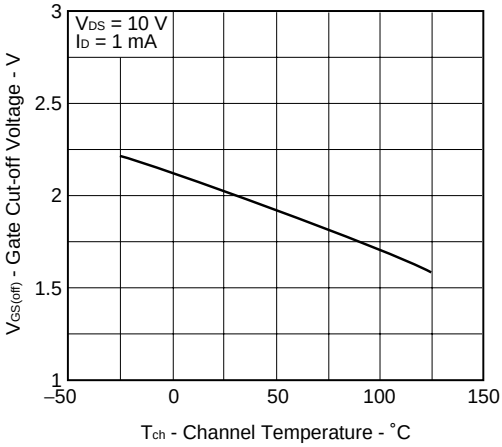
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



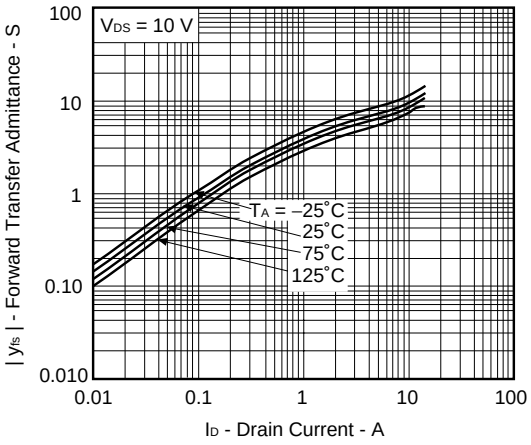
FORWARD TRANSFER CHARACTERISTICS



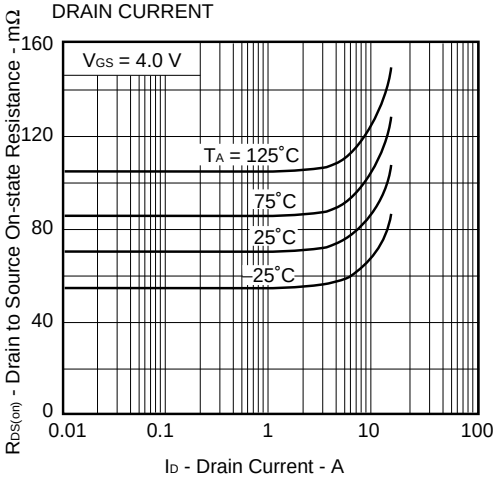
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



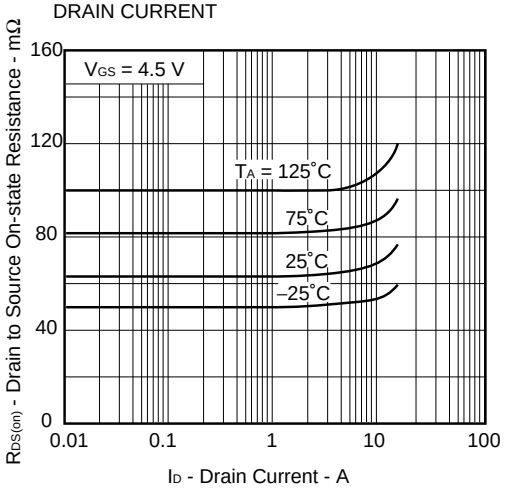
FORWARD TRANSFER ADMITTANCE Vs. DRAIN CURRENT



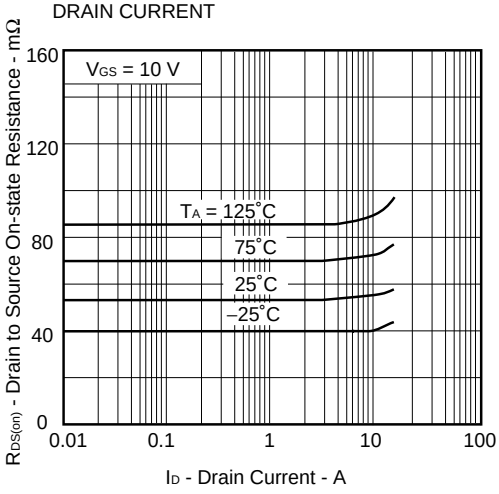
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



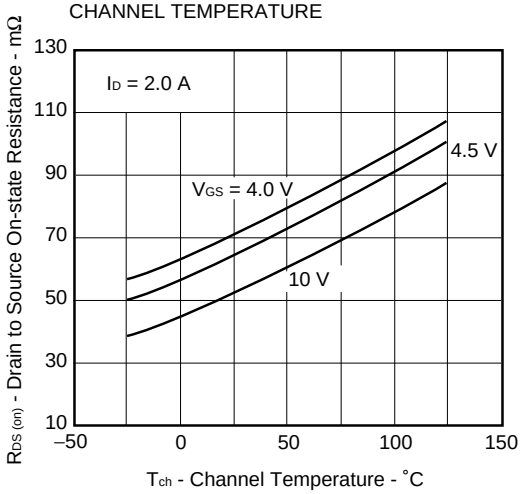
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



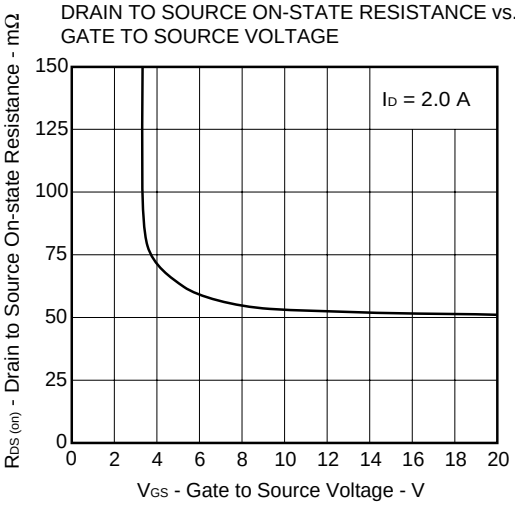
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



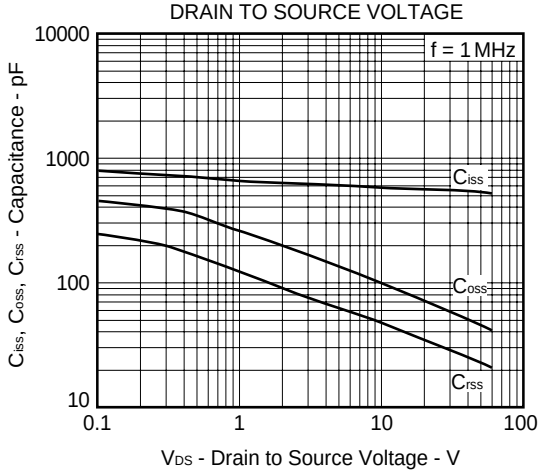
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



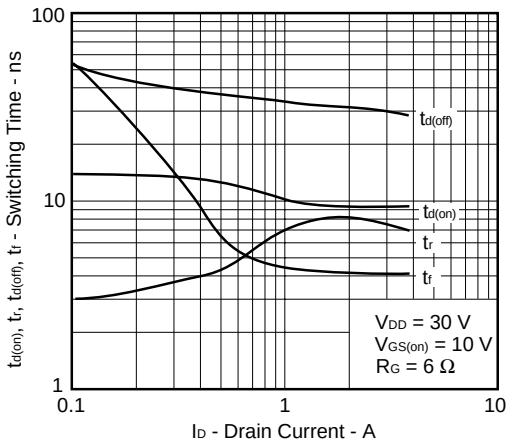
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



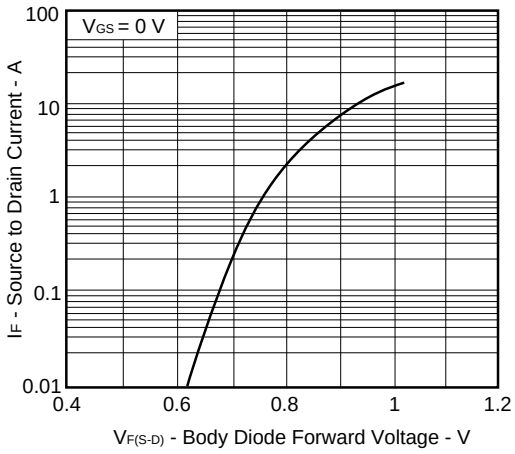
CAPACITANCE vs.
DRAIN TO SOURCE VOLTAGE



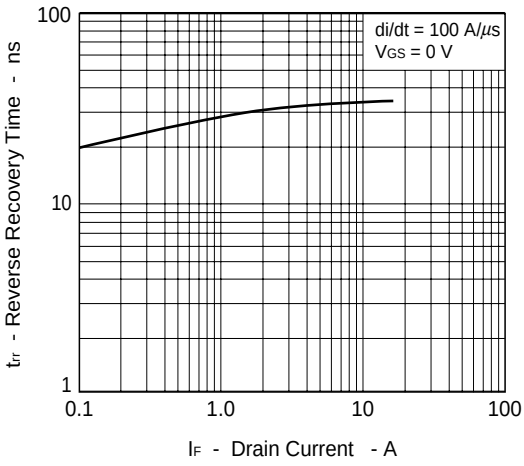
SWITCHING CHARACTERISTICS



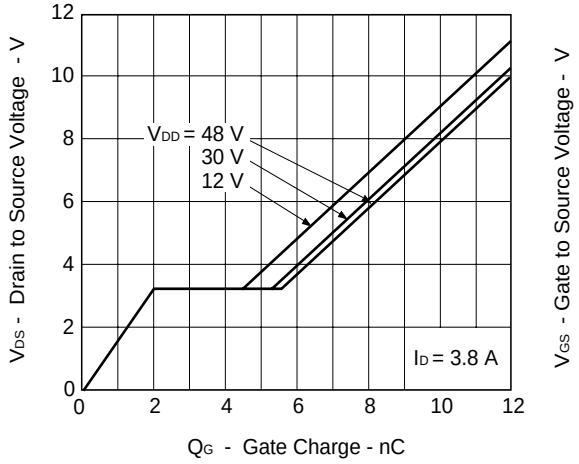
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



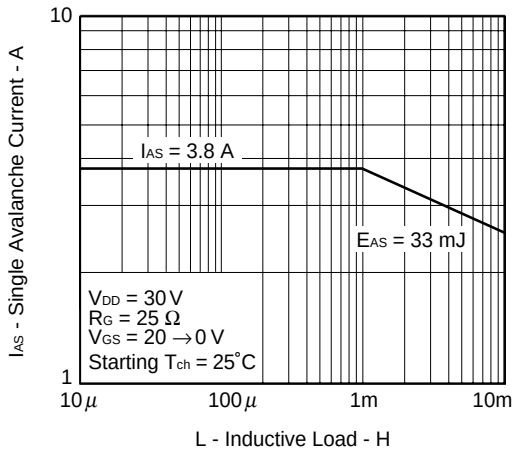
REVERSE RECOVERY TIME vs.
DRAIN CURRENT



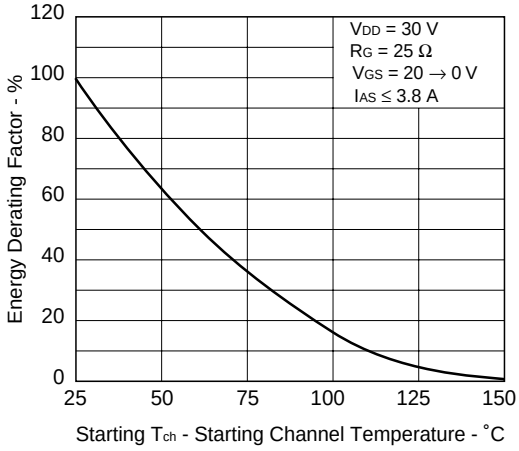
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



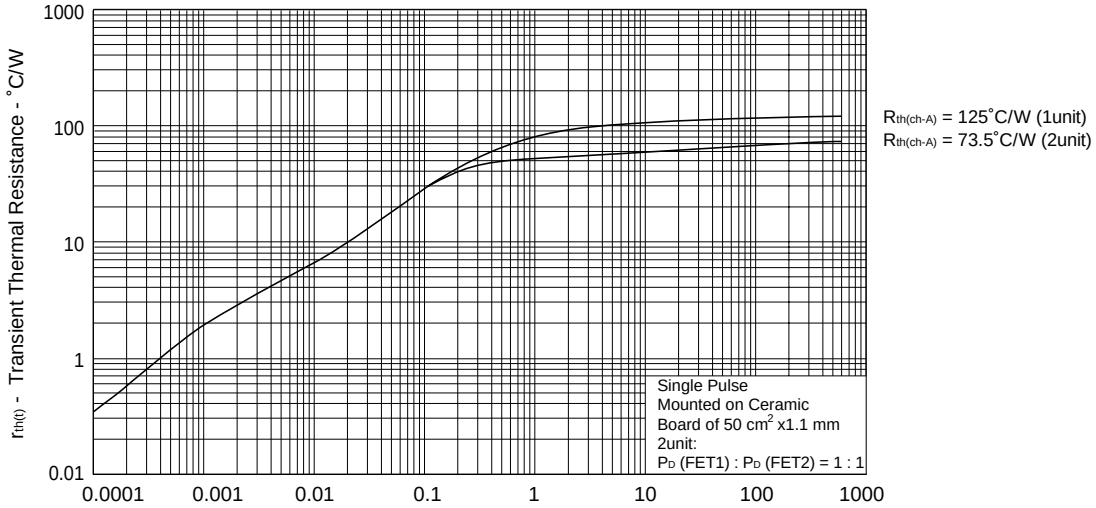
SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD



SINGLE AVALANCHE ENERGY DERATING FACTOR



★ TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



[MEMO]

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