NEC

MOS FIELD EFFECT TRANSISTOR

μPA1870

N-CHANNEL MOS FIELD EFFECT TRANSISTOR FOR SWITCHING

DESCRIPTION

The μPA1870 is a switching device which can be driven directly by a 2.5-V power source.

The μPA1870 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.

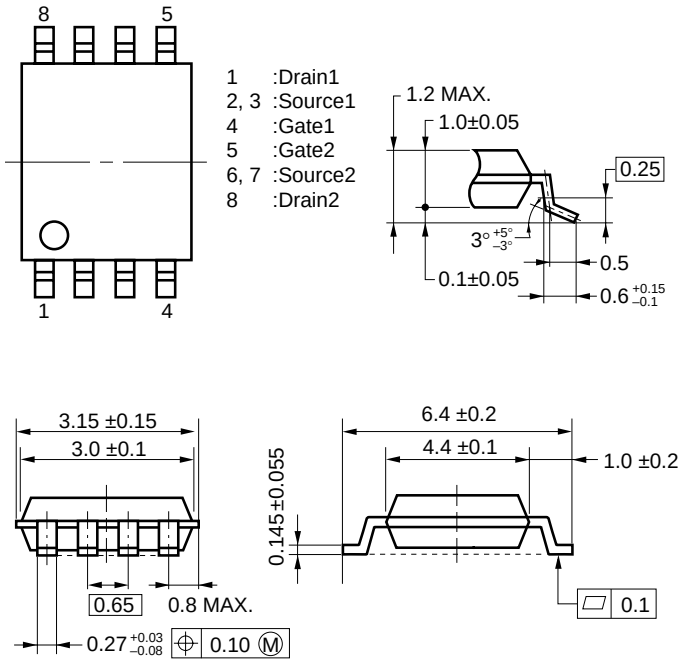
FEATURES

- Can be driven by a 2.5-V power source
- Low on-state resistance
  $R_{DS(on)1}$ = 20.0 mΩ MAX. (V_{GS} = 4.5 V, I_D = 3.0 A)
  $R_{DS(on)2}$ = 21.0 mΩ MAX. (V_{GS} = 4.0 V, I_D = 3.0 A)
  $R_{DS(on)3}$ = 27.0 mΩ MAX. (V_{GS} = 2.5 V, I_D = 3.0 A)
- Built-in G-S protection diode against ESD

ORDERING INFORMATION

PART NUMBER	PACKAGE
μPA1870GR-9JG	Power TSSOP8

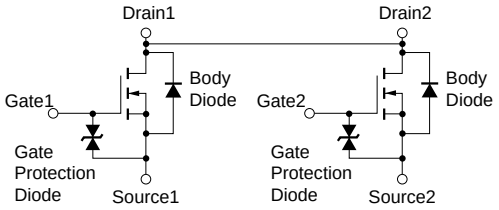
PACKAGE DRAWING (Unit: mm)



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage	V_{DSS}	20	V
Gate to Source Voltage	V_{GSS}	±12	V
Drain Current (DC)	$I_{D(DC)}$	±6.0	A
Drain Current (pulse) Note 1	$I_{D(pulse)}$	±80	A
Total Power Dissipation Note 2	P_T	2.0	W
Channel Temperature	T_{ch}	150	°C
Storage Temperature	T_{stg}	–55 to +150	°C

EQUIVALENT CIRCUIT



Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. Mounted on ceramic substrate of 50 cm^2 x 1.1 mm

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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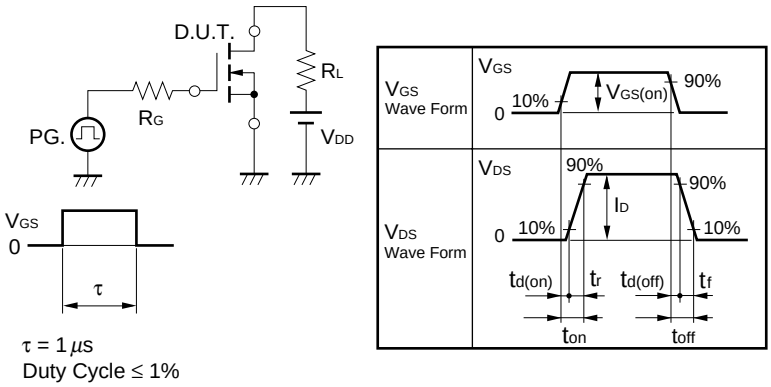
The mark ★ shows major revised points.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

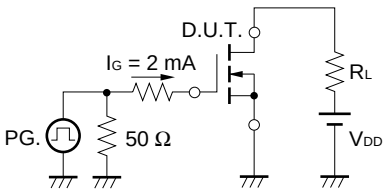
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V			10	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±12 V, V_{DS} = 0 V			±10	μA
Gate Cut-off Voltage	$V_{GS(off)}$	V_{DS} = 10 V, I_D = 1 mA	0.5	1.0	1.5	V
Forward Transfer Admittance	$\|y_{fs}\|$	V_{DS} = 10 V, I_D = 3.0 A	5			S
Drain to Source On-state Resistance	$R_{DS(on)1}$	V_{GS} = 4.5 V, I_D = 3.0 A	12.0	15.0	20.0	mΩ
	$R_{DS(on)2}$	V_{GS} = 4.0 V, I_D = 3.0 A	13.0	15.5	21.0	mΩ
	$R_{DS(on)3}$	V_{GS} = 2.5 V, I_D = 3.0 A	15.0	20.8	27.0	mΩ
Input Capacitance	C_{iss}	V_{DS} = 10 V		900		pF
Output Capacitance	C_{oss}	V_{GS} = 0 V		295		pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		170		pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 10 V, I_D = 3.0 A		55		ns
Rise Time	t_r	$V_{GS(on)}$ = 4.0 V		210		ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 10 Ω		300		ns
Fall Time	t_f			340		ns
Total Gate Charge	Q_G	V_{DD} = 16 V		10		nC
Gate to Source Charge	Q_{GS}	V_{GS} = 4.0 V		2		nC
Gate to Drain Charge	Q_{GD}	I_D = 6.0 A		6		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	I_F = 6.0 A, V_{GS} = 0 V		0.80		V
Reverse Recovery Time	t_{rr}	I_F = 6.0 A, V_{GS} = 0 V		400		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 50 A/μs		1000		nC

TEST CIRCUIT 1 SWITCHING TIME



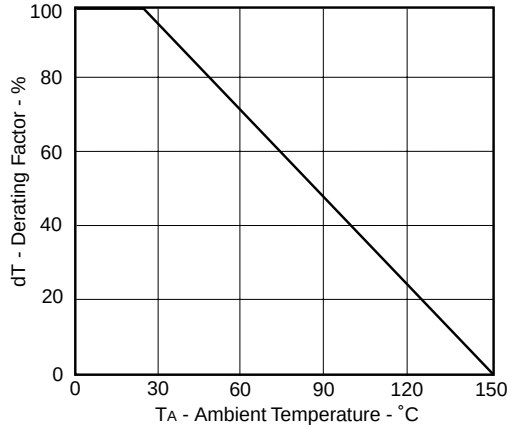
τ = 1 μs
Duty Cycle ≤ 1%

TEST CIRCUIT 2 GATE CHARGE

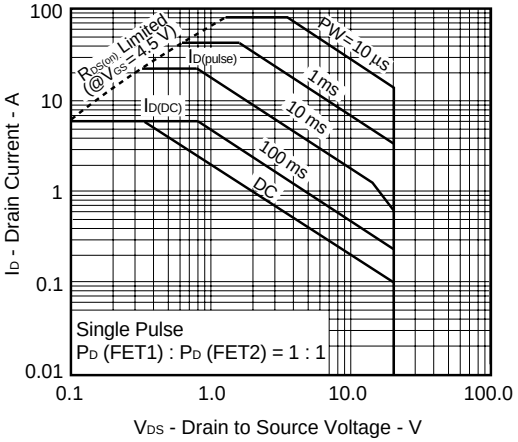


TYPICAL CHARACTERISTICS (T_A = 25°C)

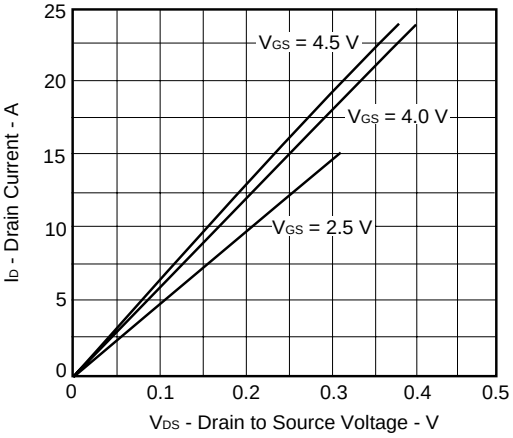
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



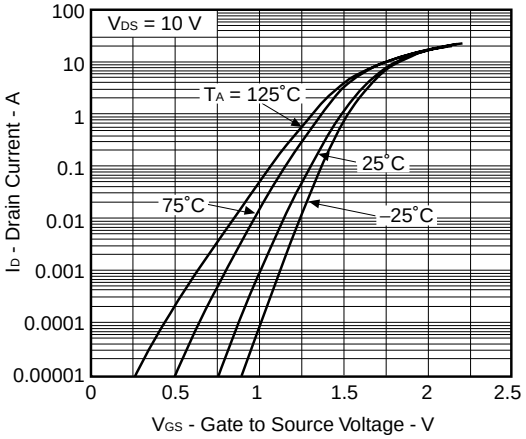
★ FORWARD BIAS SAFE OPERATING AREA



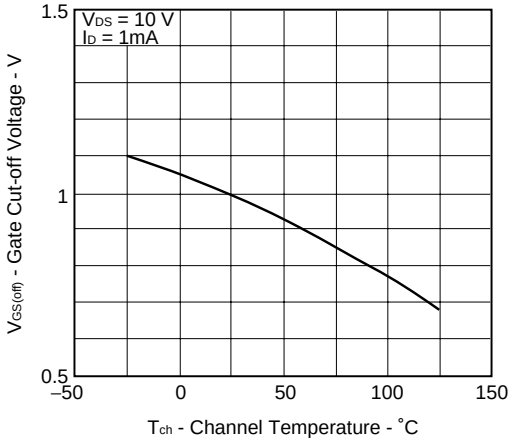
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



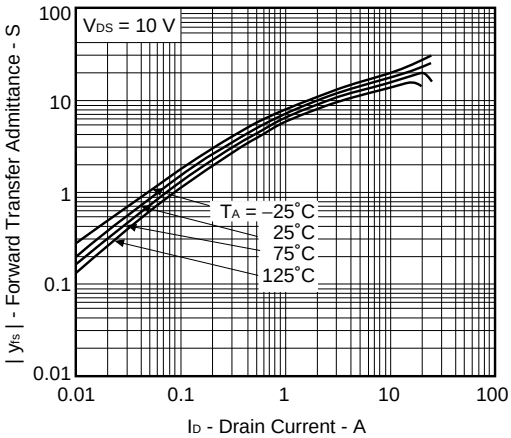
FORWARD TRANSFER CHARACTERISTICS



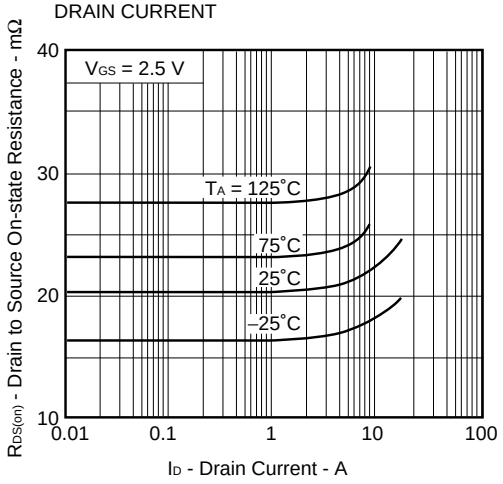
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



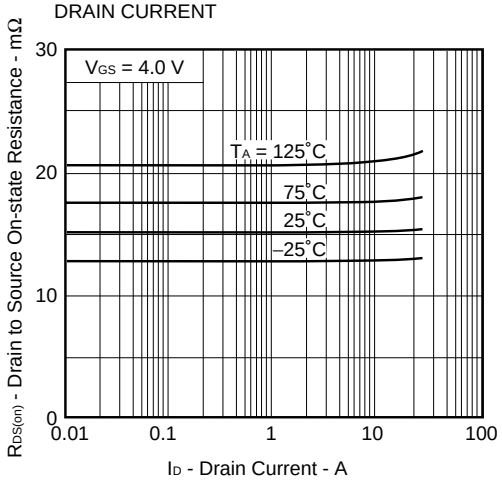
FORWARD TRANSFER ADMITTANCE Vs. DRAIN CURRENT



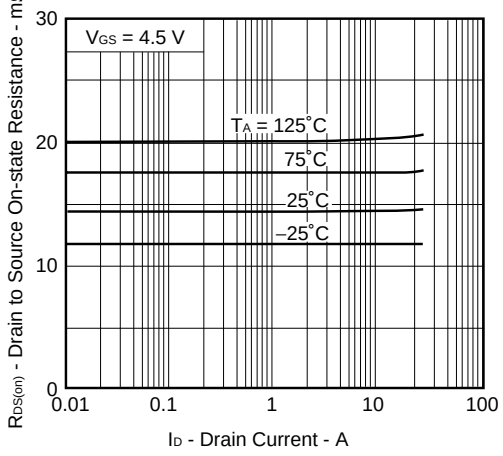
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



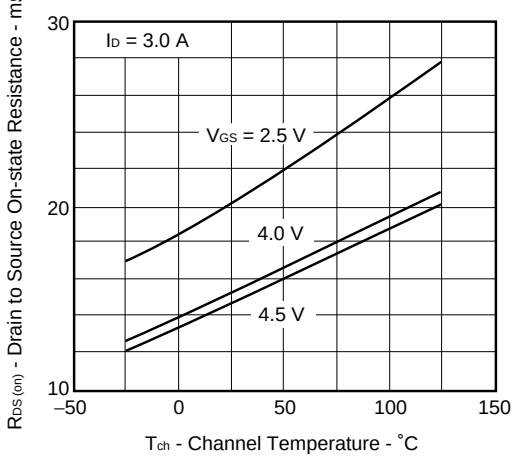
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



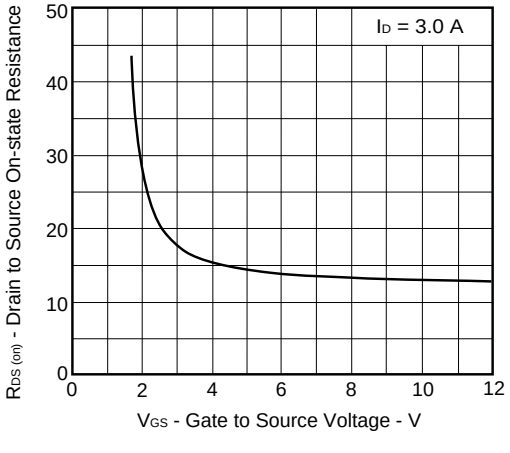
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



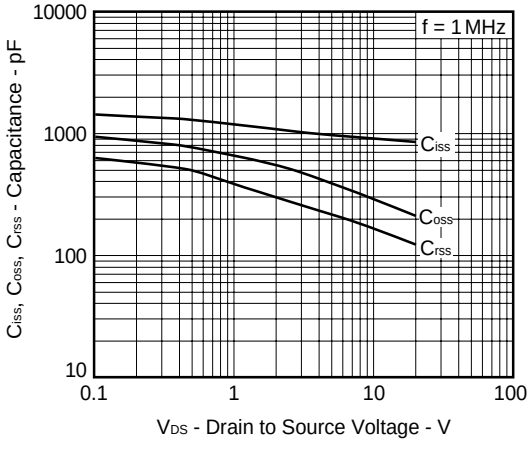
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
CHANNEL TEMPERATURE



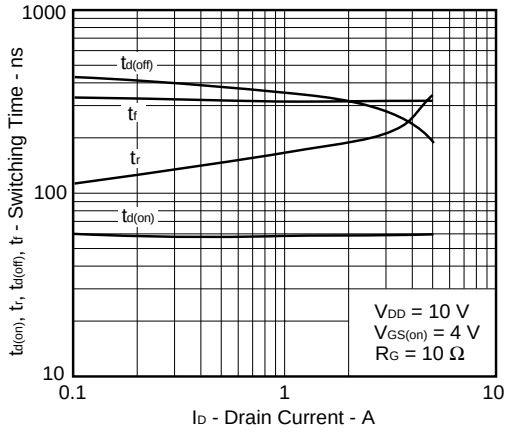
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



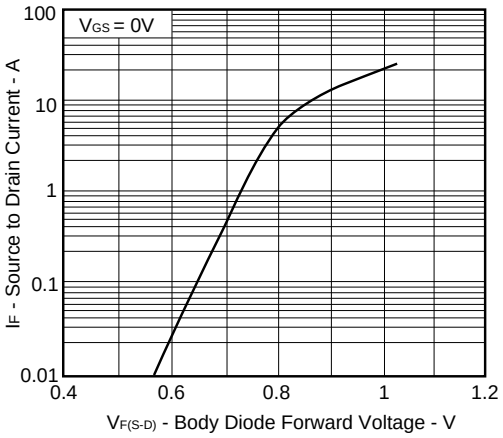
CAPACITANCE vs.
DRAIN TO SOURCE VOLTAGE



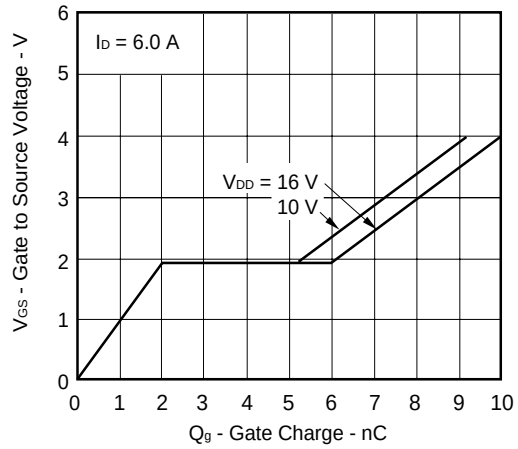
SWITCHING CHARACTERISTICS



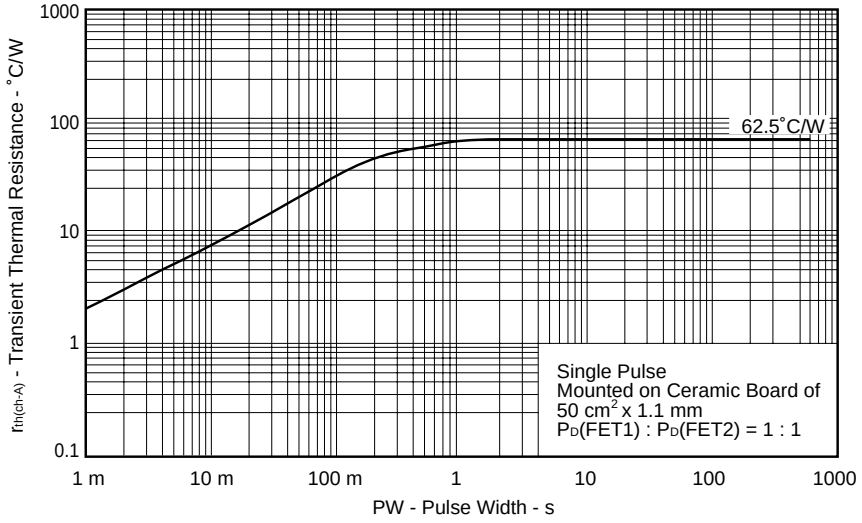
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



DYNAMIC INPUT CHARACTERISTICS



★ TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



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