

N- AND P-CHANNEL MOSFET FOR SWITCHING

DESCRIPTION

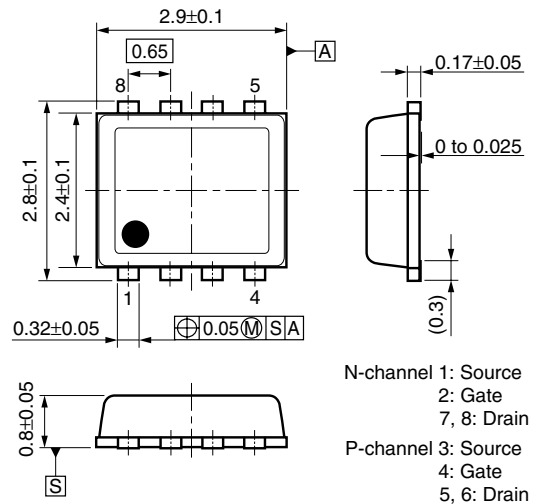
The μ PA2590 is N- and P-channel MOSFETs designed for DC/DC converters and power management applications of portable equipments.

N- and P-channel MOSFETs are assembled in one package, to contribute minimize the equipments.

FEATURES

- 4.5 V drive available
- Low on-state resistance
 - N-channel $R_{DS(on)1} = 50 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 10 \text{ V}$, $I_D = 2 \text{ A}$)
 - $R_{DS(on)2} = 83 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 4.5 \text{ V}$, $I_D = 2 \text{ A}$)
 - P-channel $R_{DS(on)1} = 72 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = -10 \text{ V}$, $I_D = -2 \text{ A}$)
 - $R_{DS(on)2} = 105 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = -4.5 \text{ V}$, $I_D = -2 \text{ A}$)
- Built-in gate protection diode
- Small and surface mount package (8-pin VSOF (2429))

PACKAGE DRAWING (Unit: mm)



ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE
μ PA2590T1H-T1-AT ^{Note}	Pure Sn	8 mm embossed taping	8-pin VSOF (2429)
μ PA2590T1H-T2-AT ^{Note}		3000 p/reel	

Note Pb-free (This product does not contain Pb in the external electrode and other parts.)

Marking: 2590

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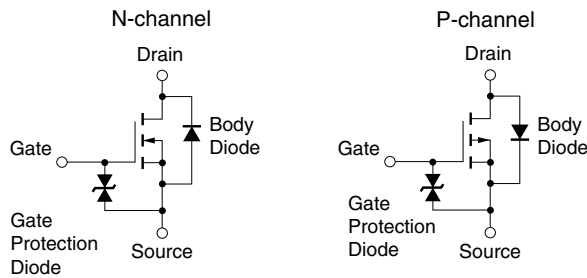
ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

PARAMETER	SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Drain to Source Voltage (VGS = 0 V)	V _{DSS}	30	-30	V
Gate to Source Voltage (VDS = 0 V)	V _{GSS}	±20	∓20	V
Drain Current (DC)	I _{D(DC)}	±4.5	∓4.5	A
Drain Current (pulse) ^{Note1}	I _{D(pulse)}	±18	∓18	A
Total Power Dissipation (1 unit, 5 s) ^{Note2}	P _{T1}	1.5		W
Total Power Dissipation (2 units, 5 s) ^{Note2}	P _{T2}	1.24		W
Channel Temperature	T _{ch}	150		°C
Storage Temperature	T _{stg}	-55 to +150		°C

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. Mounted on FR-4 board of 25.4 mm x 25.4 mm x 0.8 mm

EQUIVALENT CIRCUIT



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.

Caution This product is electrostatic-sensitive device due to low ESD capability and should be handled with caution for electrostatic discharge.

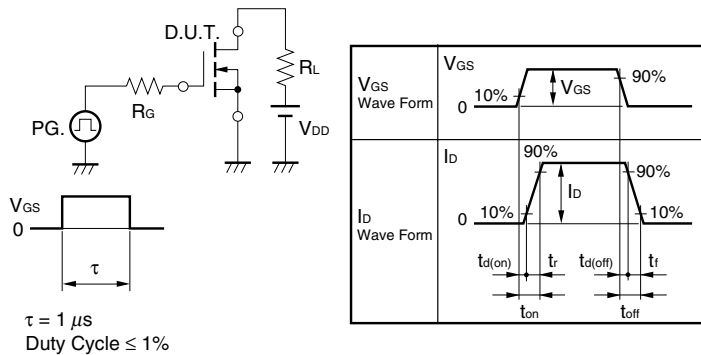
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

N-channel MOSFET

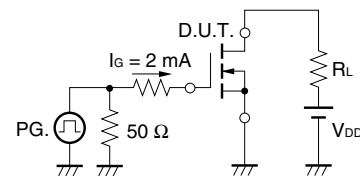
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V			1	μA
Gate Leakage Current	I _{GSS}	V _{GS} = ±16 V, V _{DS} = 0 V			±10	μA
Gate to Source Cut-off Voltage	V _{GS(off)}	V _{DS} = 10 V, I _D = 1 mA	1.0		2.5	V
Forward Transfer Admittance Note	y _{fs}	V _{DS} = 10 V, I _D = 2 A	1			S
Drain to Source On-state Resistance Note	R _{DS(on)1}	V _{GS} = 10 V, I _D = 2 A		38	50	mΩ
	R _{DS(on)2}	V _{GS} = 4.5 V, I _D = 2 A		48	83	mΩ
Input Capacitance	C _{iss}	V _{DS} = 10 V,		310		pF
Output Capacitance	C _{oss}	V _{GS} = 0 V,		65		pF
Reverse Transfer Capacitance	C _{rss}	f = 1.0 MHz		27		pF
Turn-on Delay Time	t _{d(on)}	V _{DD} = 15 V, I _D = 2 A,		6		ns
Rise Time	t _r	V _{GS} = 10 V,		2.8		ns
Turn-off Delay Time	t _{d(off)}	R _G = 6 Ω		15		ns
Fall Time	t _f			2.4		ns
Total Gate Charge	Q _G	V _{DD} = 24 V, V _{GS} = 10 V, I _D = 4.5 A		6.6		nC
Body Diode Forward Voltage Note	V _{F(S-D)}	I _F = 4.5 A, V _{GS} = 0 V		0.9		V

Note Pulsed

TEST CIRCUIT 1 SWITCHING TIME



TEST CIRCUIT 2 GATE CHARGE

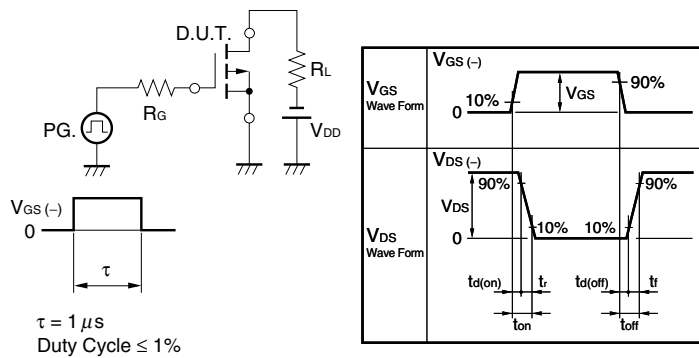


P-channel MOSFET

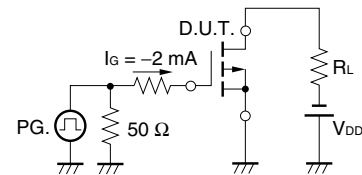
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$			-1	μA
Gate Leakage Current	I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$			±10	μA
Gate to Source Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$	1.0		2.5	V
Forward Transfer Admittance ^{Note}	$ y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -2\text{ A}$	1			S
Drain to Source On-state Resistance ^{Note}	$R_{DS(on)1}$	$V_{GS} = -10\text{ V}, I_D = -2\text{ A}$		56	72	mΩ
	$R_{DS(on)2}$	$V_{GS} = -4.5\text{ V}, I_D = -2\text{ A}$		75	105	mΩ
Input Capacitance	C_{iss}	$V_{DS} = -10\text{ V},$ $V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		310		pF
Output Capacitance	C_{oss}	$V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		78		pF
Reverse Transfer Capacitance	C_{rss}	$f = 1.0\text{ MHz}$		65		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = -15\text{ V}, I_D = -2\text{ A},$ $V_{GS} = -10\text{ V},$ $R_G = 6\ \Omega$		6.5		ns
Rise Time	t_r	$V_{GS} = -10\text{ V},$ $R_G = 6\ \Omega$		3.5		ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 6\ \Omega$		33		ns
Fall Time	t_f	$R_G = 6\ \Omega$		26		ns
Total Gate Charge	Q_G	$V_{DD} = -24\text{ V}, V_{GS} = -10\text{ V},$ $I_D = -4.5\text{ A}$		7.5		nC
Body Diode Forward Voltage ^{Note}	$V_{F(S-D)}$	$I_F = -4.5\text{ A}, V_{GS} = 0\text{ V}$		0.95		V

Note Pulsed

TEST CIRCUIT 1 SWITCHING TIME



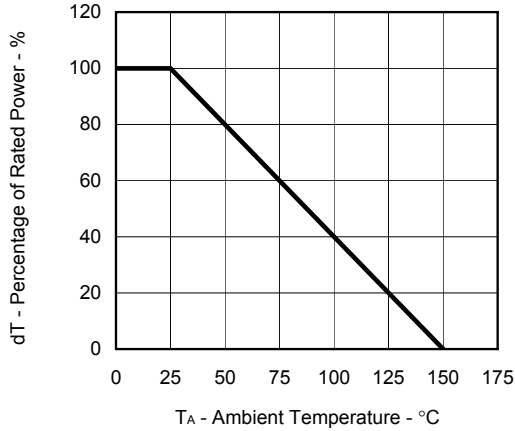
TEST CIRCUIT 2 GATE CHARGE



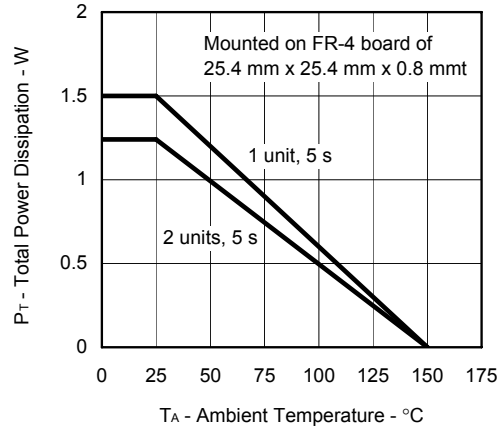
TYPICAL CHARACTERISTICS (T_A = 25°C)

(1) N-channel MOSFET

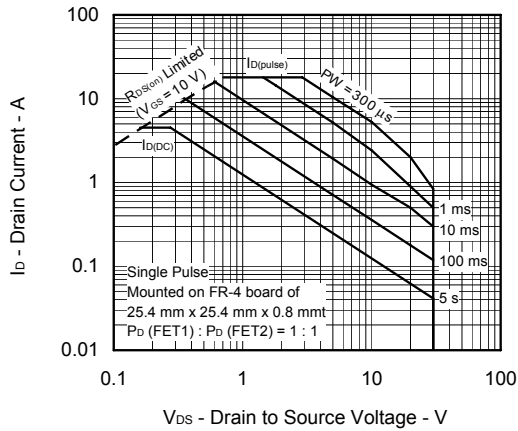
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



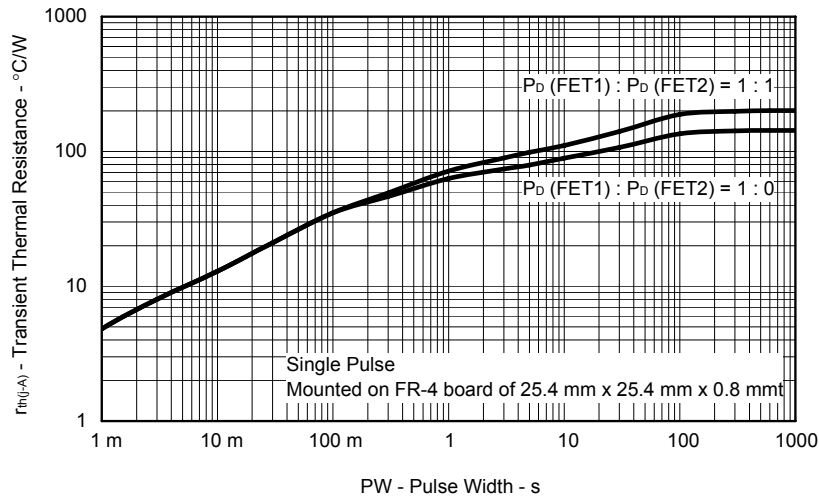
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



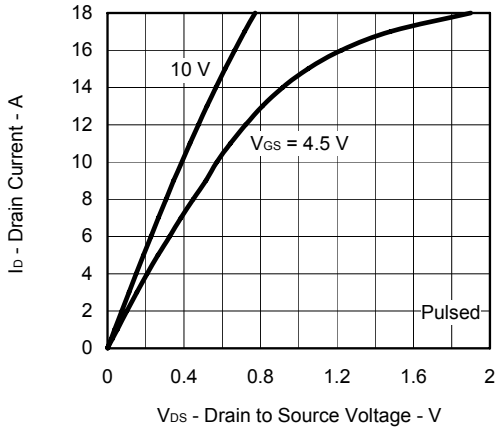
FORWARD BIAS SAFE OPERATING AREA



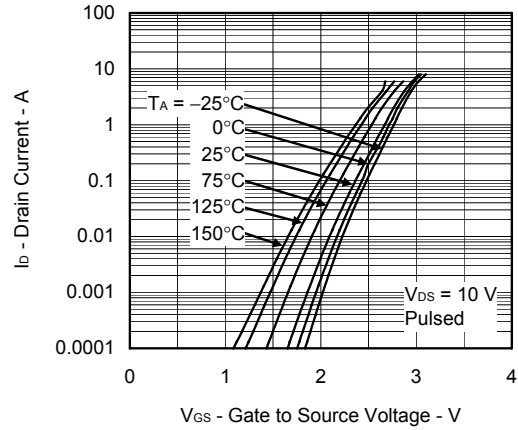
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



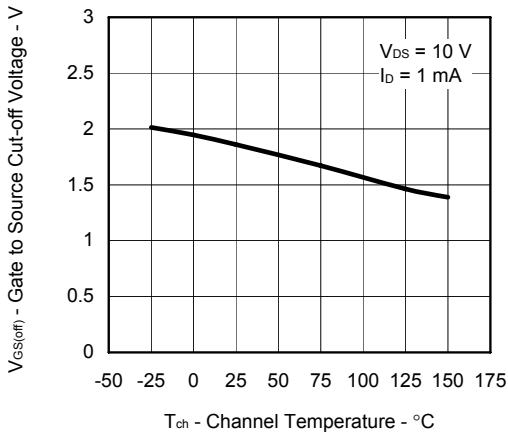
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



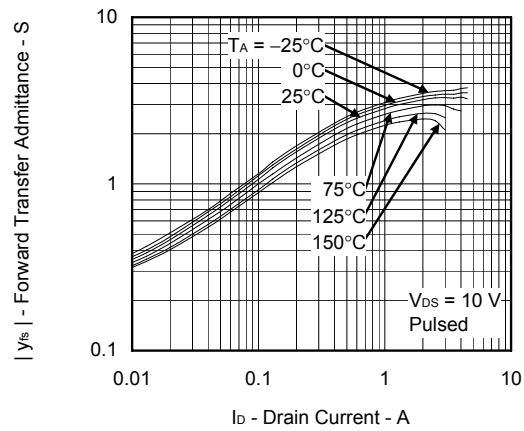
FORWARD TRANSFER CHARACTERISTICS



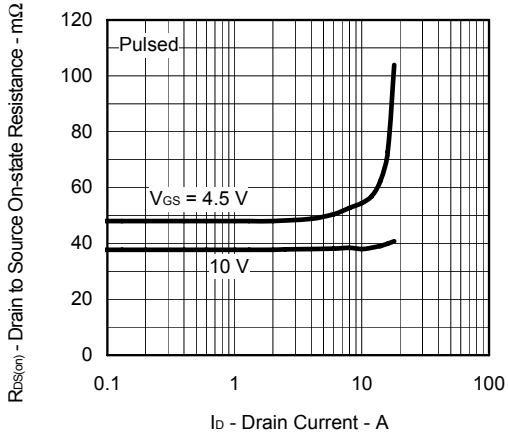
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



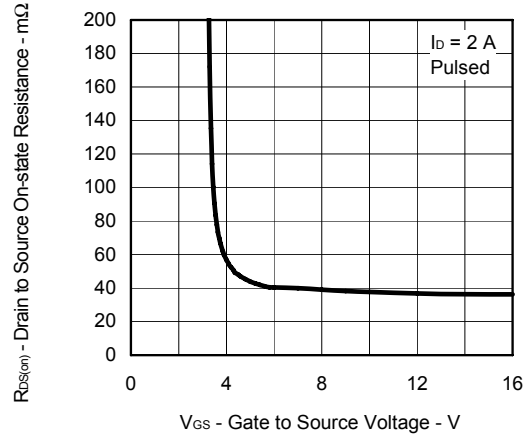
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



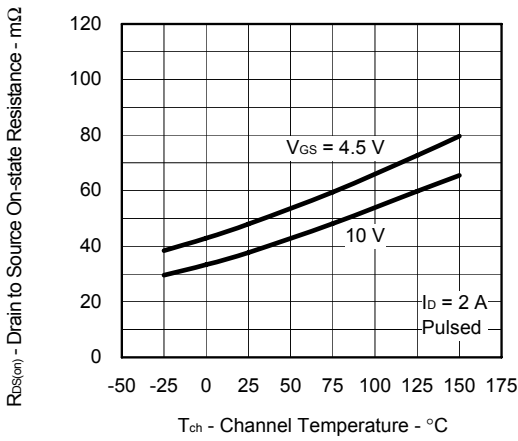
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



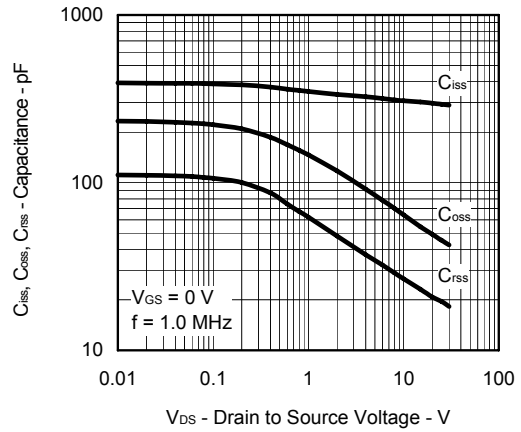
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



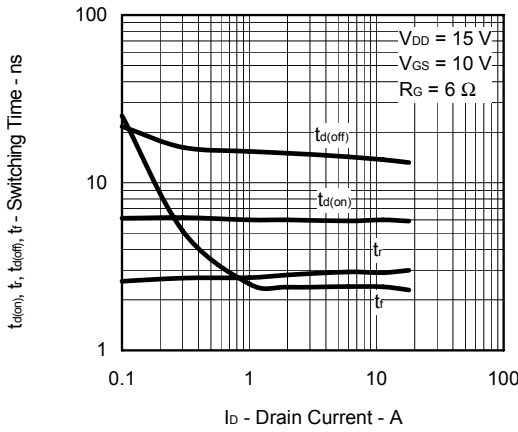
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



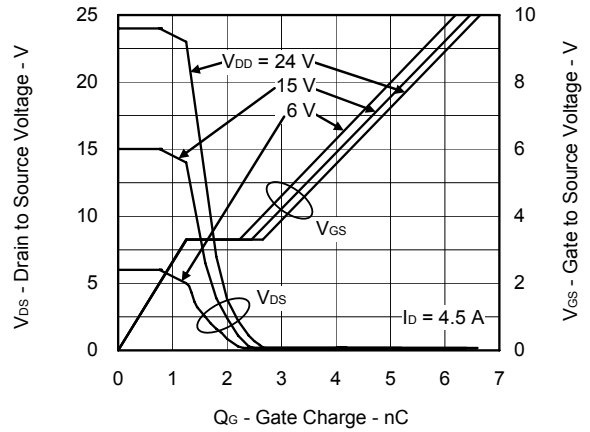
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



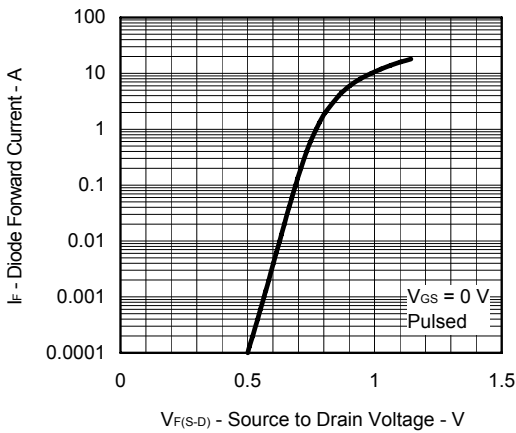
SWITCHING CHARACTERISTICS



DYNAMIC INPUT/OUTPUT CHARACTERISTICS

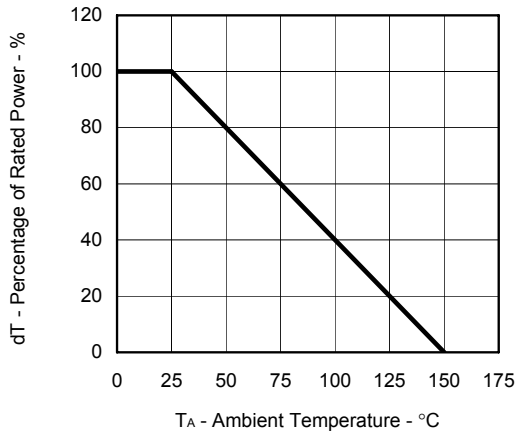


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

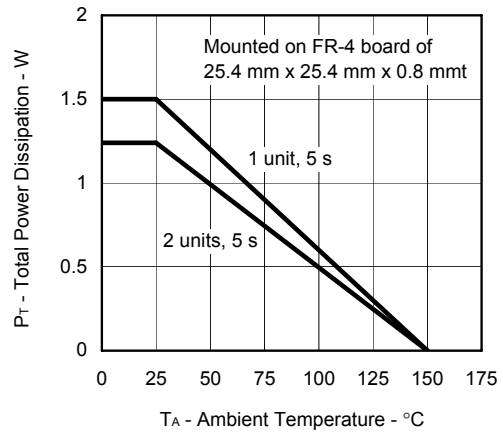


(2) P-channel MOSFET

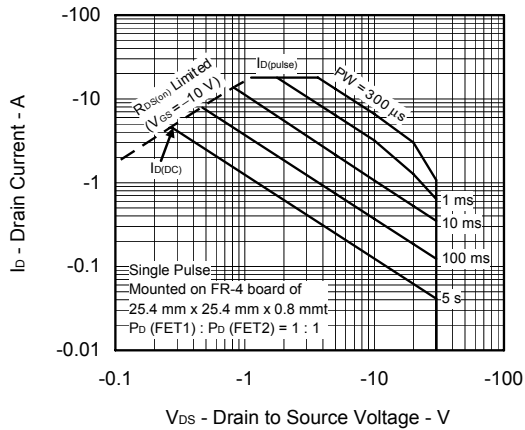
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



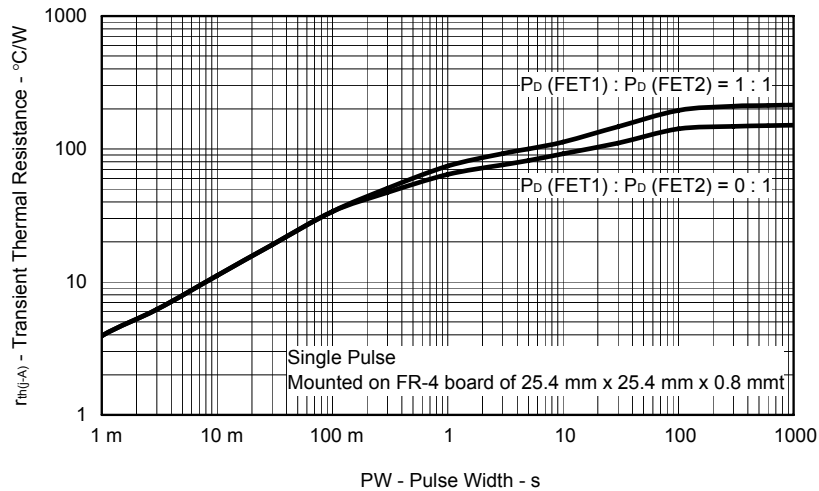
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



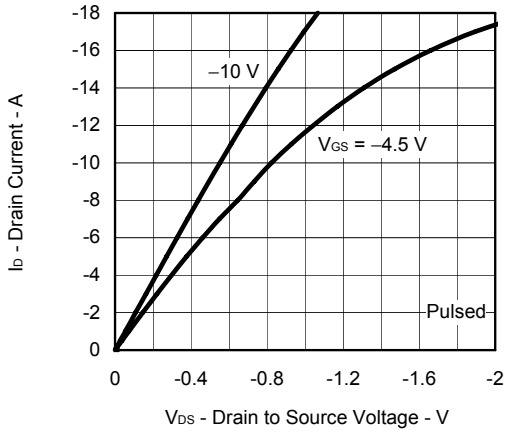
FORWARD BIAS SAFE OPERATING AREA



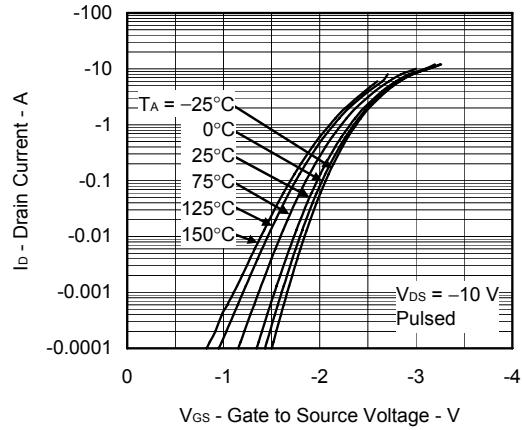
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



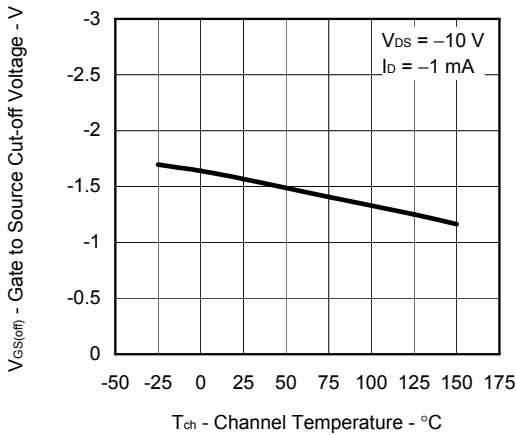
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



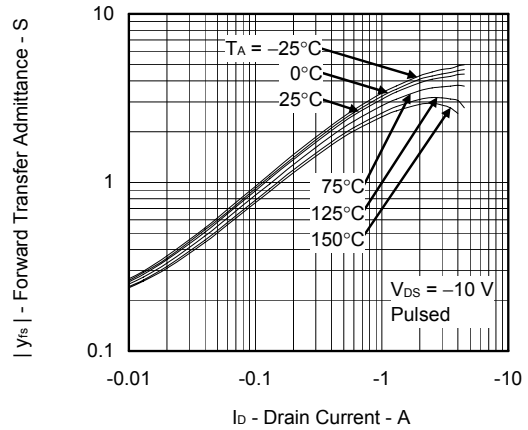
FORWARD TRANSFER CHARACTERISTICS



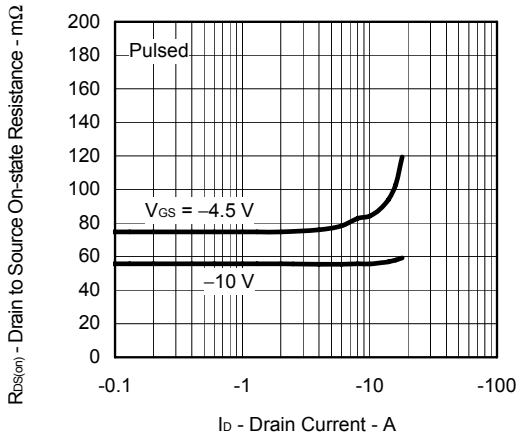
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



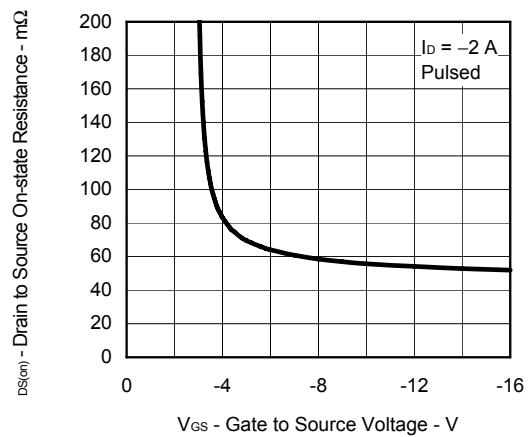
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

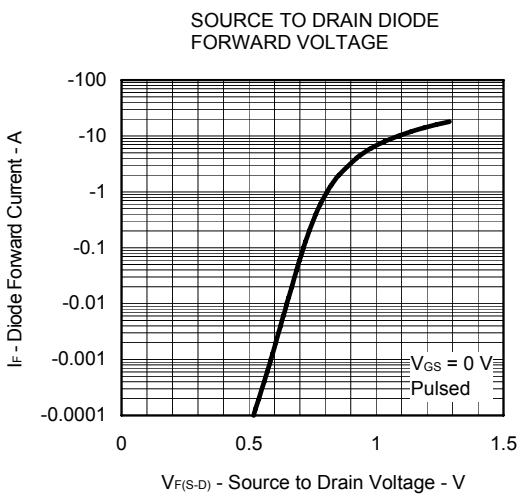
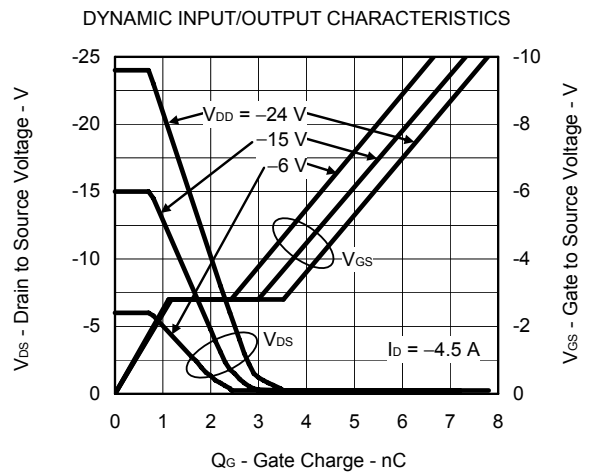
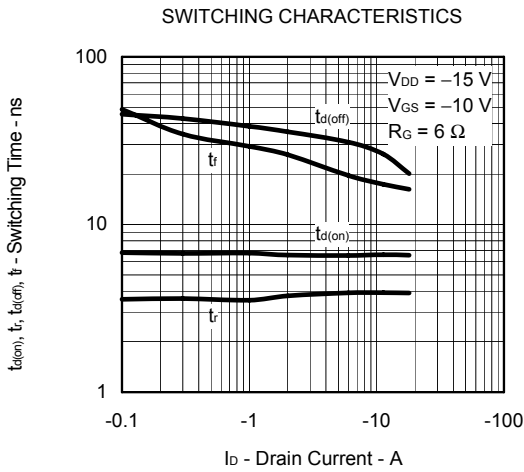
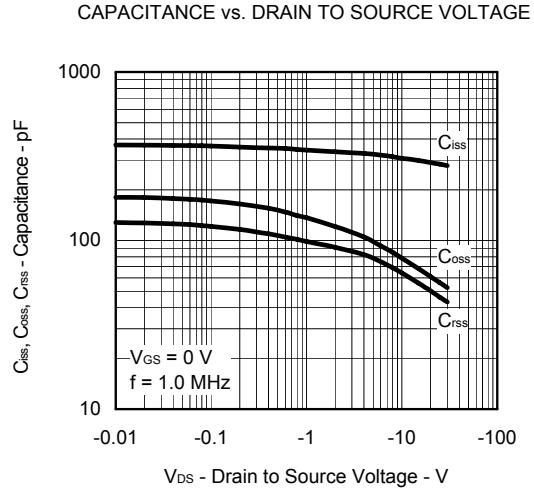
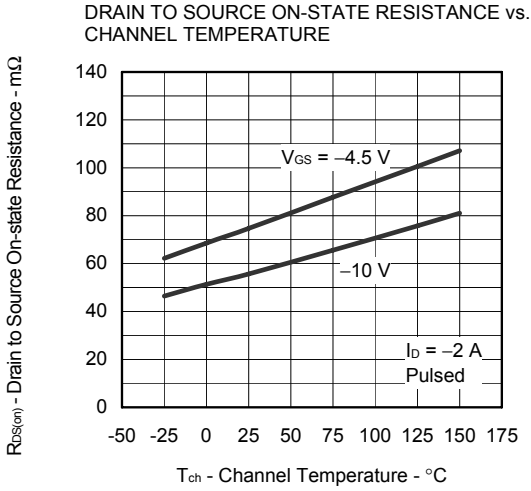


DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



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





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