

# μPA2690T1R

COMPLEMENTARY MOSFET  
20V, 4.0A, 42mΩ / -20V, -3.0A, 79mΩ

R07DS1000EJ0101  
Rev.1.01  
Mar 04, 2013

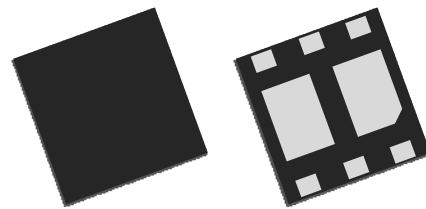
## Description

The μPA2690T1R is Dual N- and P-channel MOS Field Effect Transistors for switching application.

This device 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

- N-channel 2.5V, P-channel 1.8V drive available
- Low on-state resistance
  - N-channel
    - $R_{DS(on)1} = 42\text{ m}\Omega$  MAX. ( $V_{GS} = 4.5\text{ V}$ ,  $I_D = 2.0\text{ A}$ )
    - $R_{DS(on)2} = 62\text{ m}\Omega$  MAX. ( $V_{GS} = 2.5\text{ V}$ ,  $I_D = 2.0\text{ A}$ )
  - P-channel
    - $R_{DS(on)1} = 79\text{ m}\Omega$  MAX. ( $V_{GS} = -4.5\text{ V}$ ,  $I_D = -1.5\text{ A}$ )
    - $R_{DS(on)2} = 105\text{ m}\Omega$  MAX. ( $V_{GS} = -2.5\text{ V}$ ,  $I_D = -1.5\text{ A}$ )
    - $R_{DS(on)3} = 182\text{ m}\Omega$  MAX. ( $V_{GS} = -1.8\text{ V}$ ,  $I_D = -1.5\text{ A}$ )
- Built-in gate protection diode
- Lead-free and Halogen-free



6pinHUSON2020(Dual)

## Ordering Information

Part Number	Package
μPA2690T1R-E2-AX*1	6pinHUSON2020(Dual)

Note: \*1.Pb-free (This product does not contain Pb in the external electrode and other parts.)

## Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ )

Item	Symbol	N-CHANNEL	P-CHANNEL	Unit
Drain to Source Voltage ( $V_{GS} = 0\text{ V}$ )	$V_{DSS}$	20	-20	V
Gate to Source Voltage ( $V_{DS} = 0\text{ V}$ )	$V_{GSS}$	$\pm 12$	$\mp 10$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 4.0$	$\mp 3.0$	A
Drain Current (pulse)*1	$I_{D(pulse)}$	$\pm 16$	$\mp 12$	A
Total Power Dissipation (1 unit, 5 s)*2	$P_{T1}$	1.5		W
Total Power Dissipation (2 units, 5 s)*2	$P_{T2}$	2.3		W
Channel Temperature	$T_{ch}$	150		$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55 to +150		$^\circ\text{C}$

Notes: \*1.  $PW \leq 10\ \mu\text{s}$ , Duty Cycle  $\leq 1\%$

\*2. Mounted on glass epoxy board of 25.4mm x 25.4mm x 0.8mm

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

$V_{ESD} = \pm 400\text{V MIN.}$  (  $C = 100\text{pF}$ ,  $R = 1.5\text{K}\Omega$  )

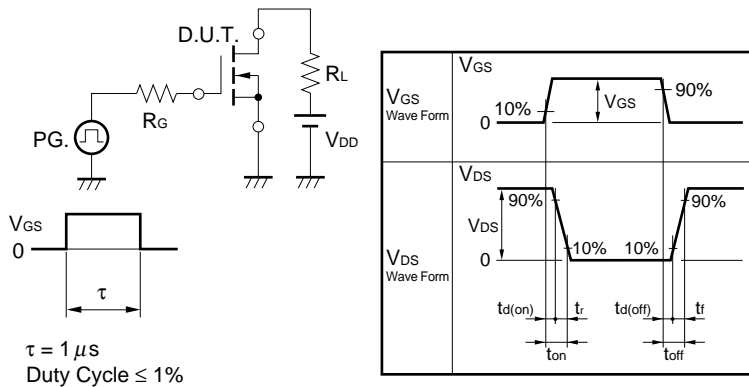
**Electrical Characteristics (T<sub>A</sub> = 25°C)**

**N-channel MOSFET**

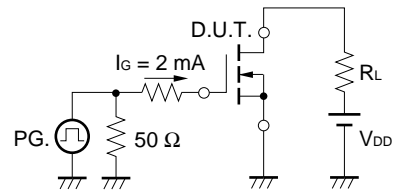
Characteristics	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I <sub>DSS</sub>			1.0	μA	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V
Gate Leakage Current	I <sub>GSS</sub>			±10	μA	V <sub>GS</sub> = ±10 V, V <sub>DS</sub> = 0 V
Gate Cut-off Voltage	V <sub>GS(off)</sub>	0.5		1.5	V	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA
Forward Transfer Admittance *1	y <sub>fs</sub>	5.0			S	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 2.0 A
Drain to Source On-state Resistance *1	R <sub>DS(on)1</sub>		33	42	mΩ	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.0 A
	R <sub>DS(on)2</sub>		43	62	mΩ	V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 2.0 A
Input Capacitance	C <sub>iss</sub>		330		pF	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz
Output Capacitance	C <sub>oss</sub>		66		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>		38		pF	
Turn-on Delay Time	t <sub>d(on)</sub>		12		ns	I <sub>D</sub> = 2.0 A, V <sub>DD</sub> = 10 V, V <sub>GS</sub> = 4.5 V, R <sub>G</sub> = 6 Ω
Rise Time	t <sub>r</sub>		6.4		ns	
Turn-off Delay Time	t <sub>d(off)</sub>		27		ns	
Fall Time	t <sub>f</sub>		6.6		ns	
Total Gate Charge	Q <sub>G</sub>		4.5		nC	I <sub>D</sub> = 4.0 A, V <sub>DD</sub> = 16 V, V <sub>GS</sub> = 10 V
Gate to Source Charge	Q <sub>GS</sub>		1.0		nC	
Gate to Drain Charge	Q <sub>GD</sub>		1.5		nC	
Body Diode Forward Voltage *1	V <sub>F(S-D)</sub>			1.5	V	I <sub>F</sub> = 4.0 A, V <sub>GS</sub> = 0 V

Note: \*1. Pulsed

**TEST CIRCUIT 1 SWITCHING TIME**



**TEST CIRCUIT 2 GATE CHARGE**

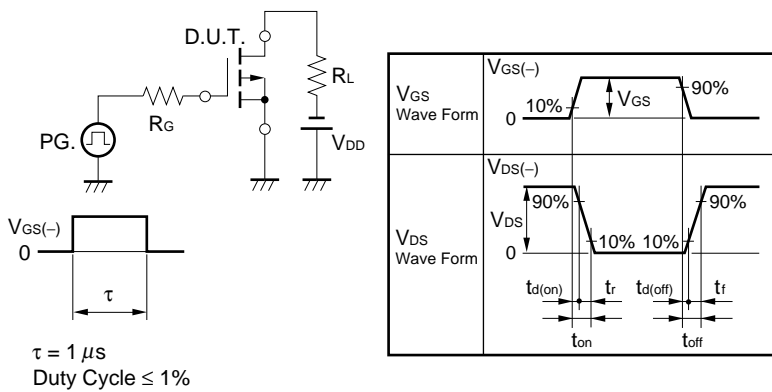


**P-channel MOSFET**

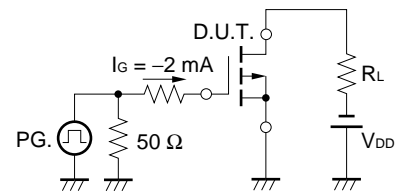
Characteristics	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	$I_{DSS}$			-1.0	μA	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$
Gate Leakage Current	$I_{GSS}$			±10	μA	$V_{GS} = \mp 8\text{ V}, V_{DS} = 0\text{ V}$
Gate Cut-off Voltage	$V_{GS(off)}$	-0.4		-1.1	V	$V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$
Forward Transfer Admittance *1	$ y_{fs} $	4.5			S	$V_{DS} = -5\text{ V}, I_D = -2\text{ A}$
Drain to Source On-state Resistance *1	$R_{DS(on)1}$		63	79	mΩ	$V_{GS} = -4.5\text{ V}, I_D = -1.5\text{ A}$
	$R_{DS(on)2}$		78	105	mΩ	$V_{GS} = -2.5\text{ V}, I_D = -1.5\text{ A}$
	$R_{DS(on)3}$		109	182	mΩ	$V_{GS} = -1.8\text{ V}, I_D = -1.5\text{ A}$
Input Capacitance	$C_{iss}$		473		pF	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$
Output Capacitance	$C_{oss}$		88		pF	
Reverse Transfer Capacitance	$C_{rss}$		68		pF	
Turn-on Delay Time	$t_{d(on)}$		11.5		ns	$I_D = -1.5\text{ A}, V_{DD} = -10.0\text{ V}, V_{GS} = -4.0\text{ V}, R_G = 6\text{ }\Omega$
Rise Time	$t_r$		4.0		ns	
Turn-off Delay Time	$t_{d(off)}$		37.5		ns	
Fall Time	$t_f$		12.5		ns	
Total Gate Charge	$Q_G$		5.1		nC	$I_D = -3.0\text{ A}, V_{DD} = -16\text{ V}, V_{GS} = -4.5\text{ V}$
Gate to Source Charge	$Q_{GS}$		0.9		nC	
Gate to Drain Charge	$Q_{GD}$		1.5		nC	
Body Diode Forward Voltage *1	$V_{F(S-D)}$			1.5	V	$I_F = 3.0\text{ A}, V_{GS} = 0\text{ V}$

Note: \*1. Pulsed

**TEST CIRCUIT 1 SWITCHING TIME**



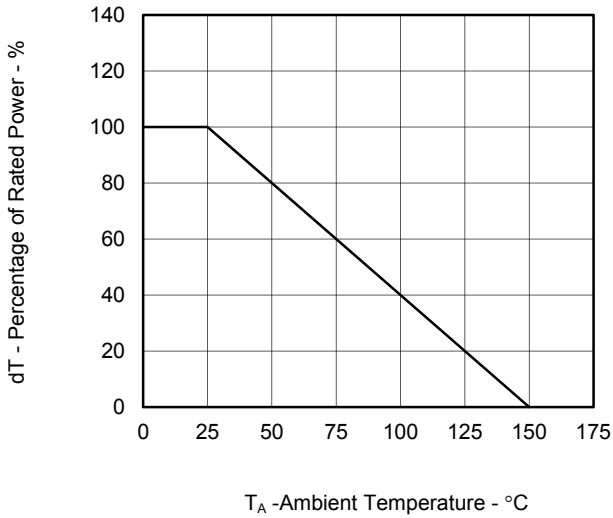
**TEST CIRCUIT 2 GATE CHARGE**



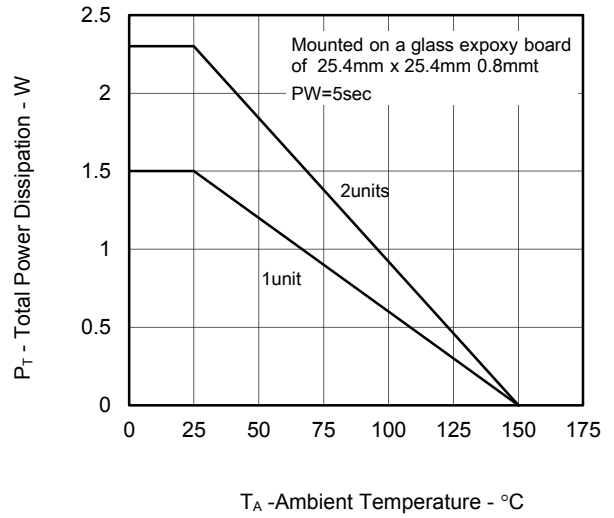
Typical Characteristics (T<sub>A</sub> = 25°C)

N-channel MOSFET

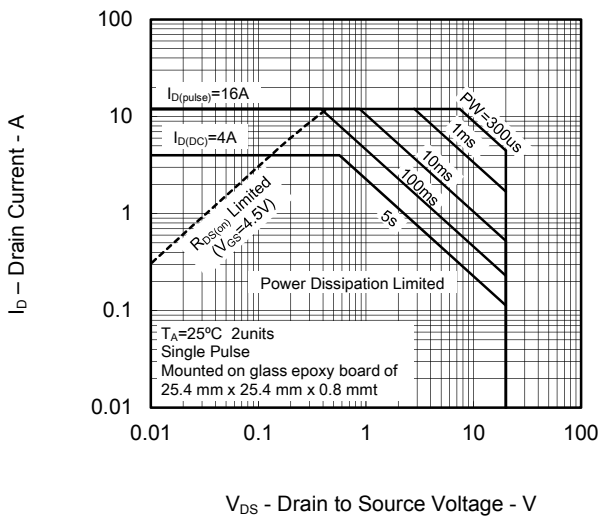
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



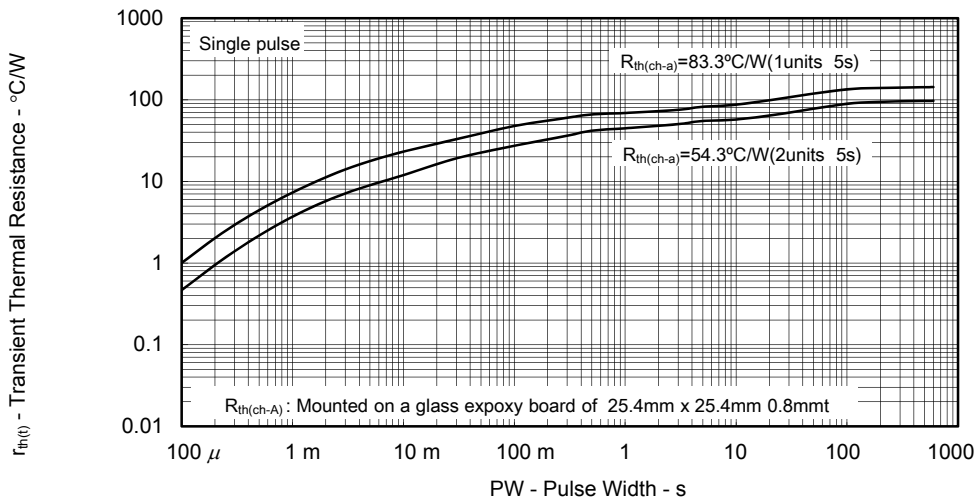
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



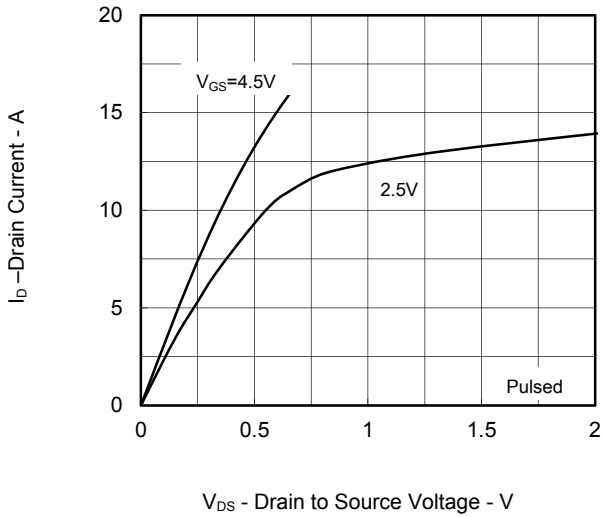
FORWARD BIAS SAFE OPERATING AREA



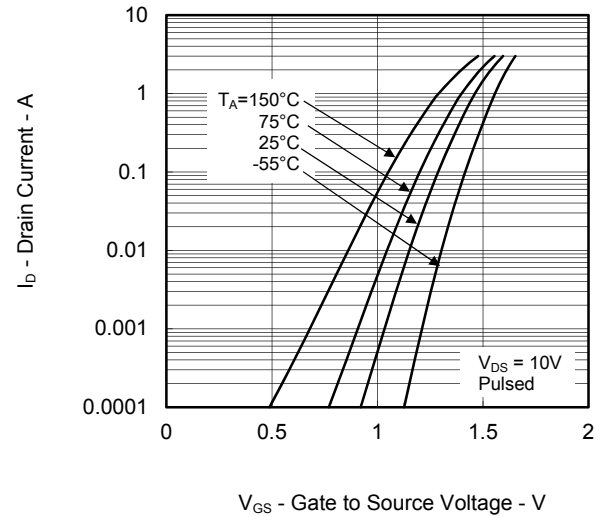
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



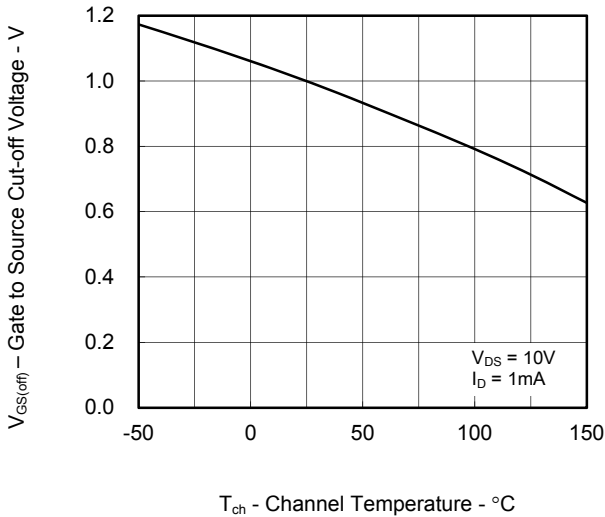
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



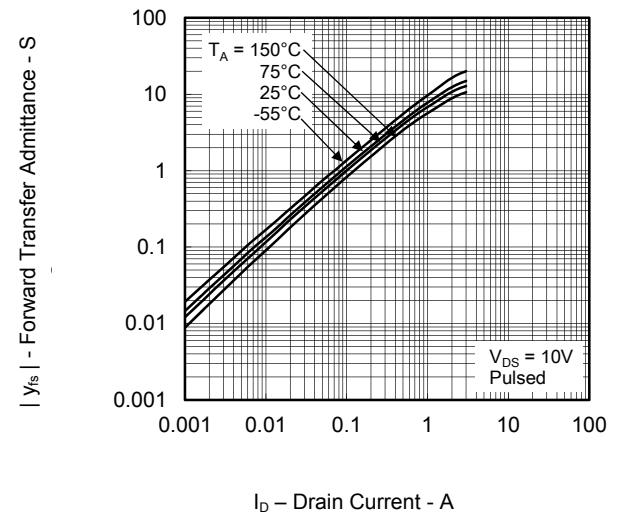
FORWARD TRANSFER CHARACTERISTICS



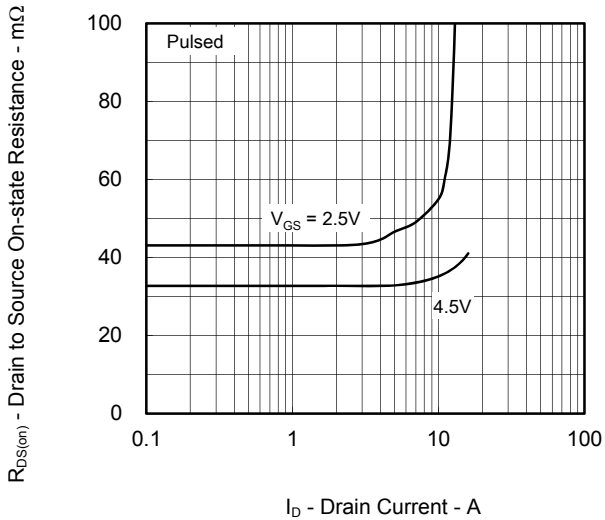
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



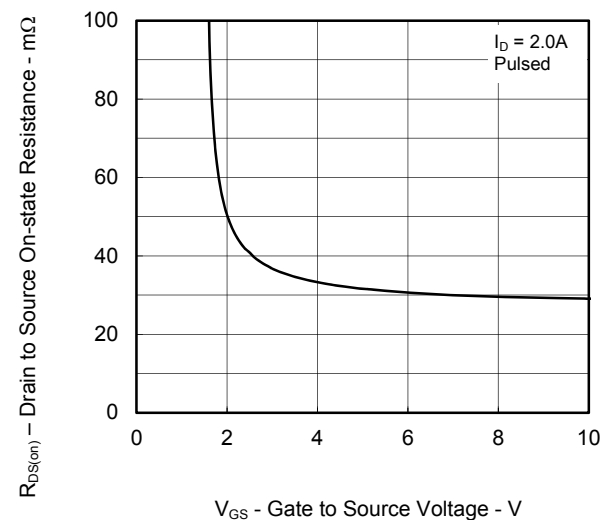
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



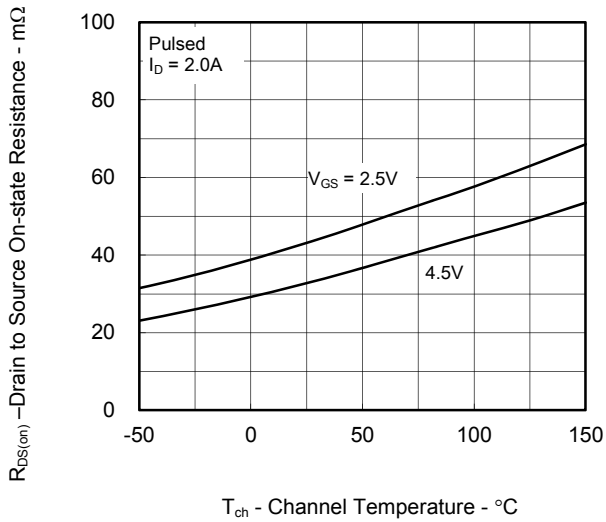
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



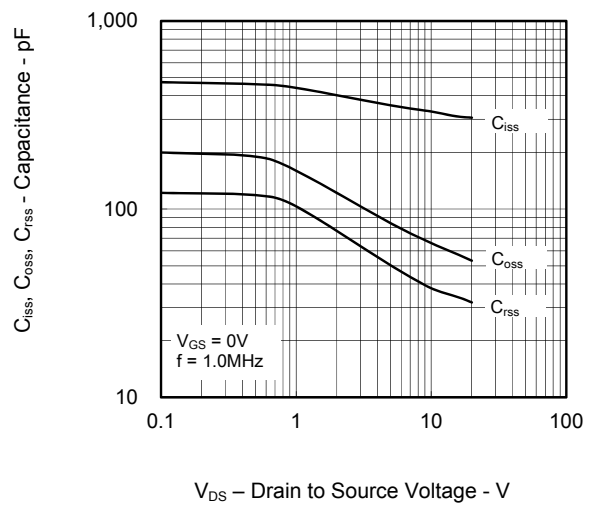
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



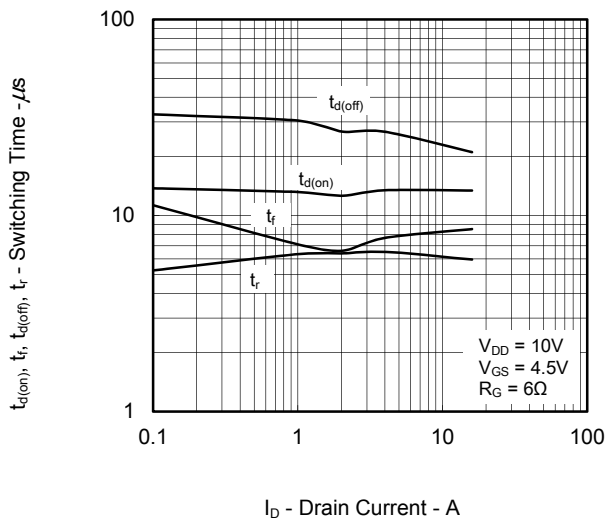
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



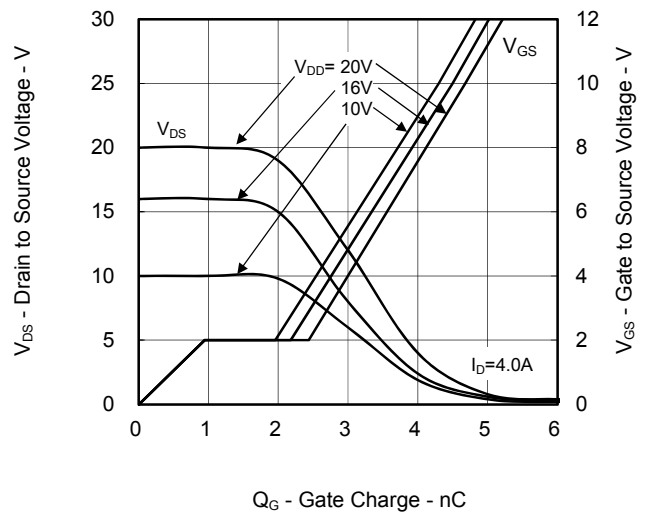
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



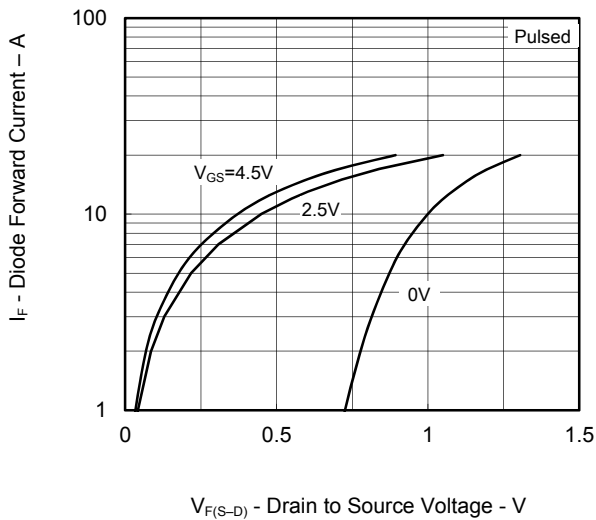
SWITCHING CHARACTERISTICS



DYNAMIC INPUT/OUTPUT CHARACTERISTICS

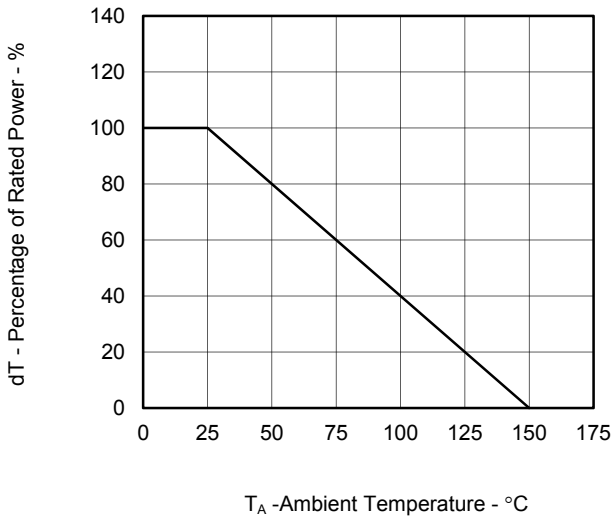


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

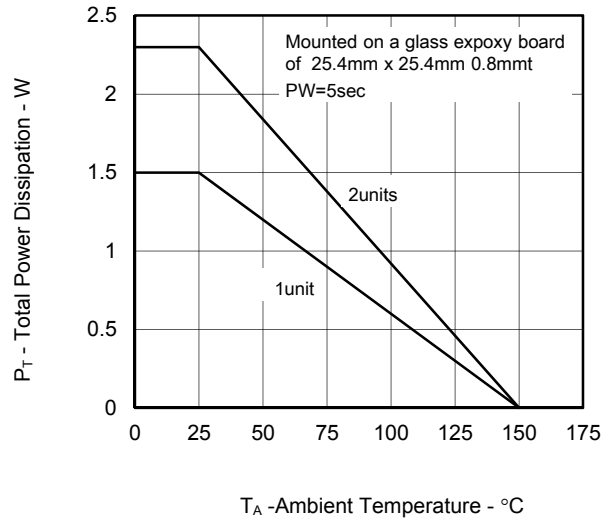


P-channel MOSFET

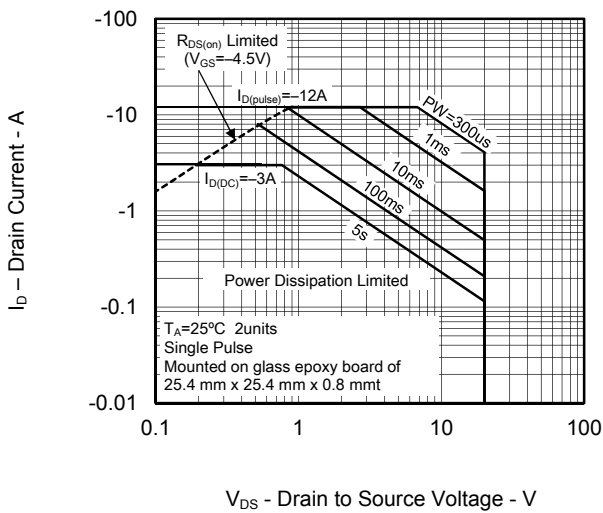
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



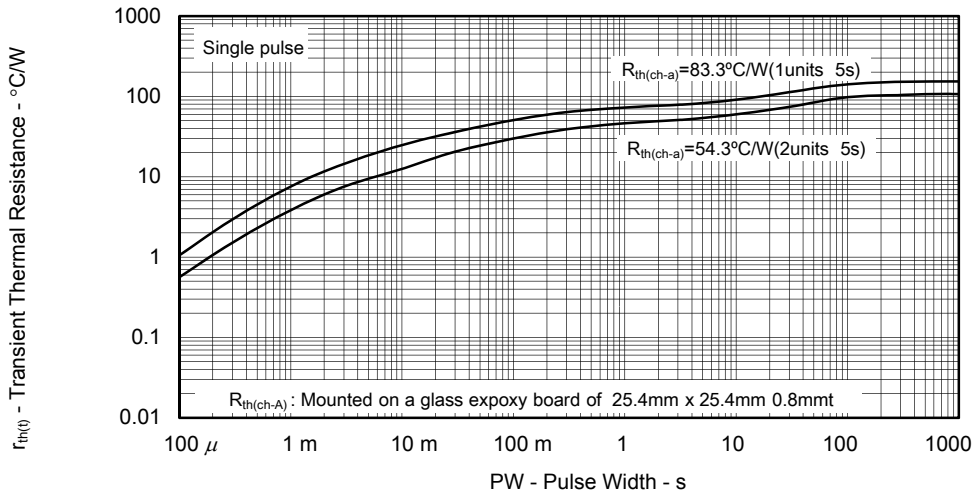
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



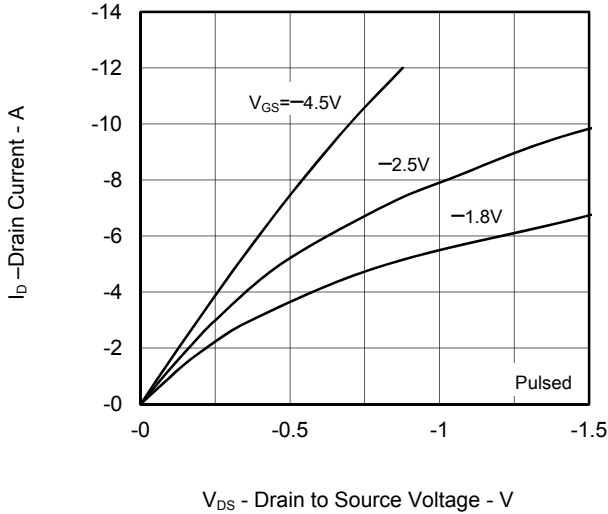
FORWARD BIAS SAFE OPERATING AREA



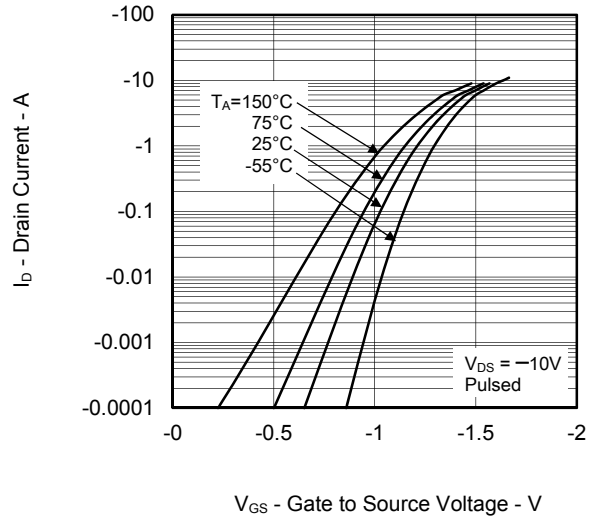
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



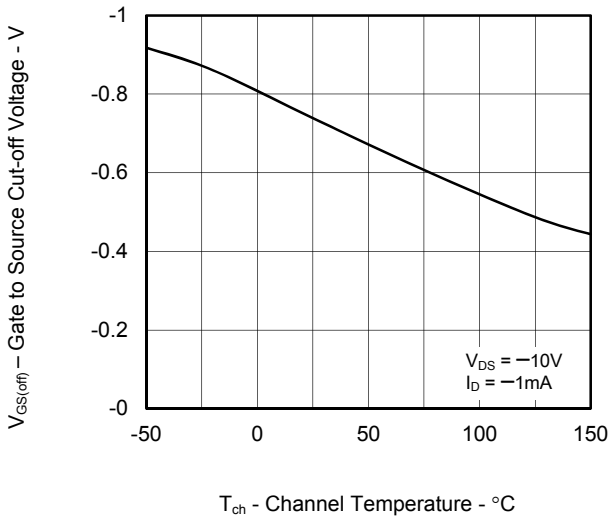
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



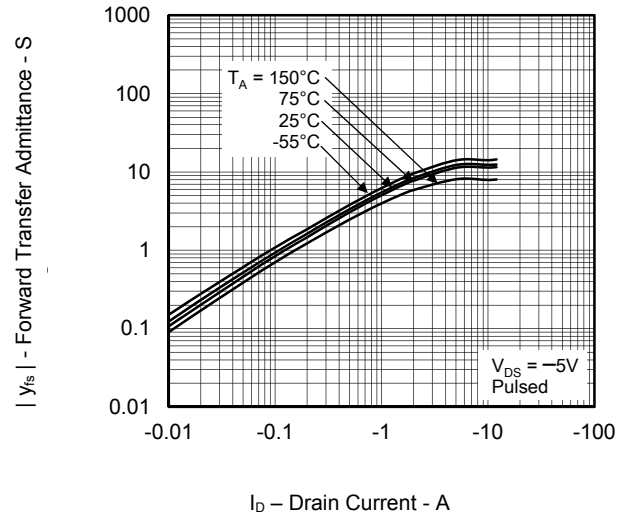
FORWARD TRANSFER CHARACTERISTICS



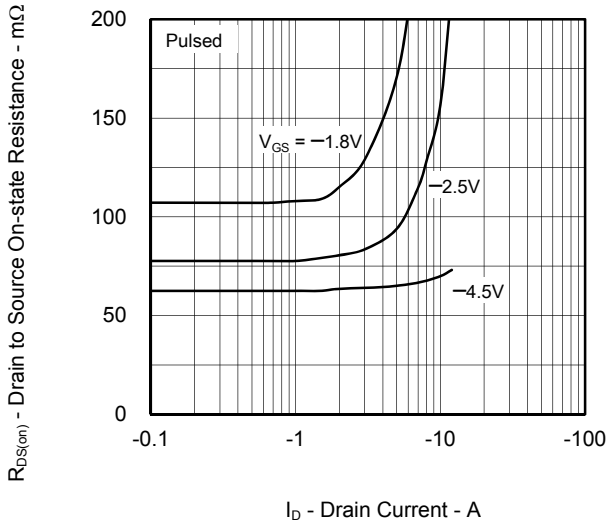
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



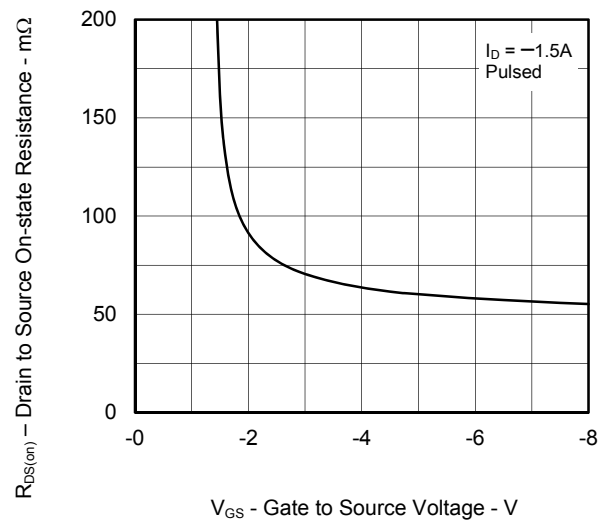
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

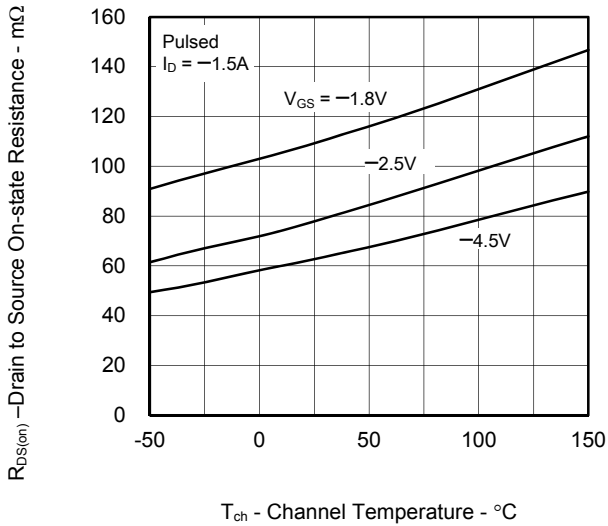


DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

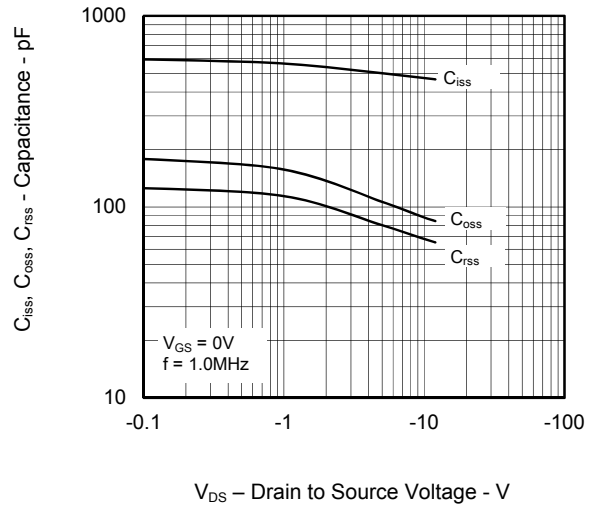




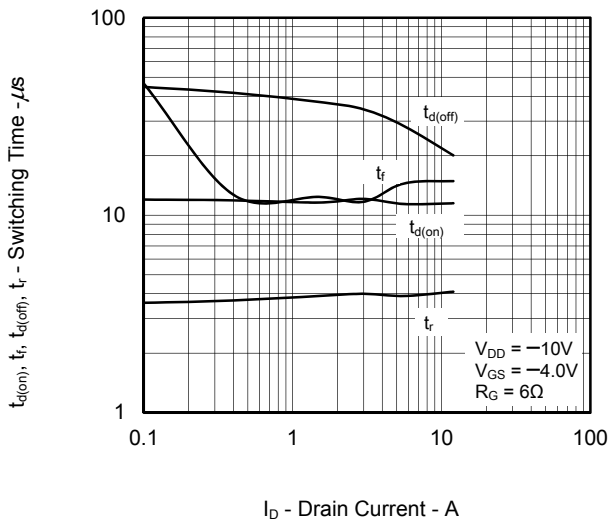
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



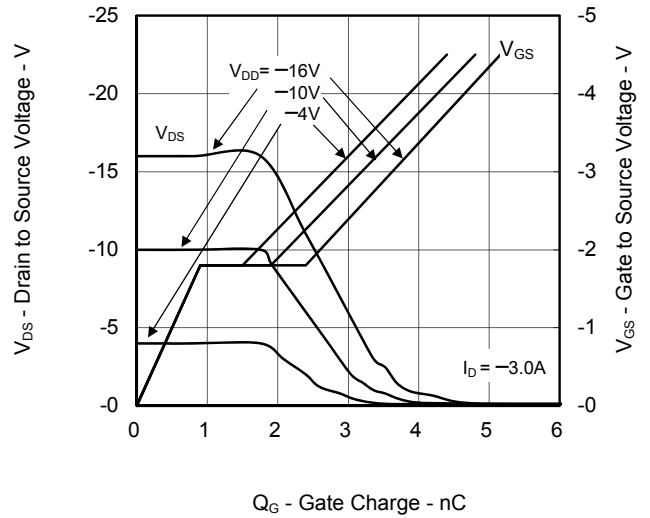
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



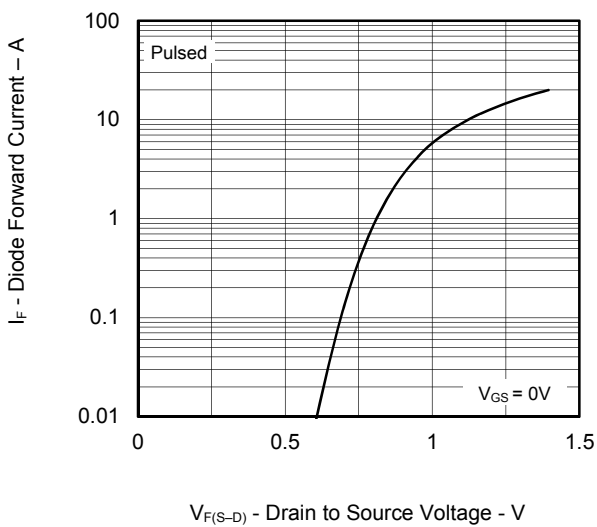
SWITCHING CHARACTERISTICS



DYNAMIC INPUT/OUTPUT CHARACTERISTICS

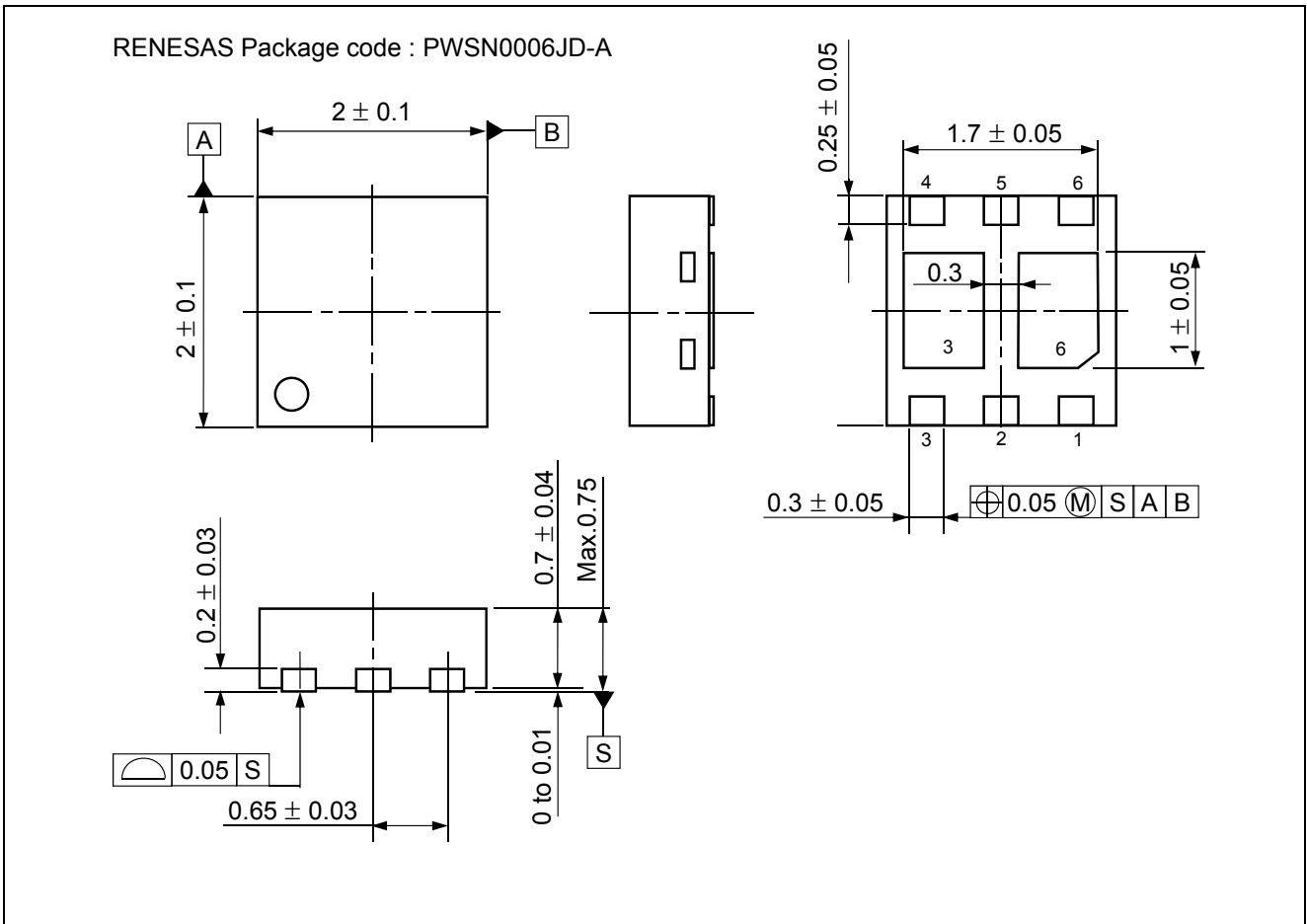


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

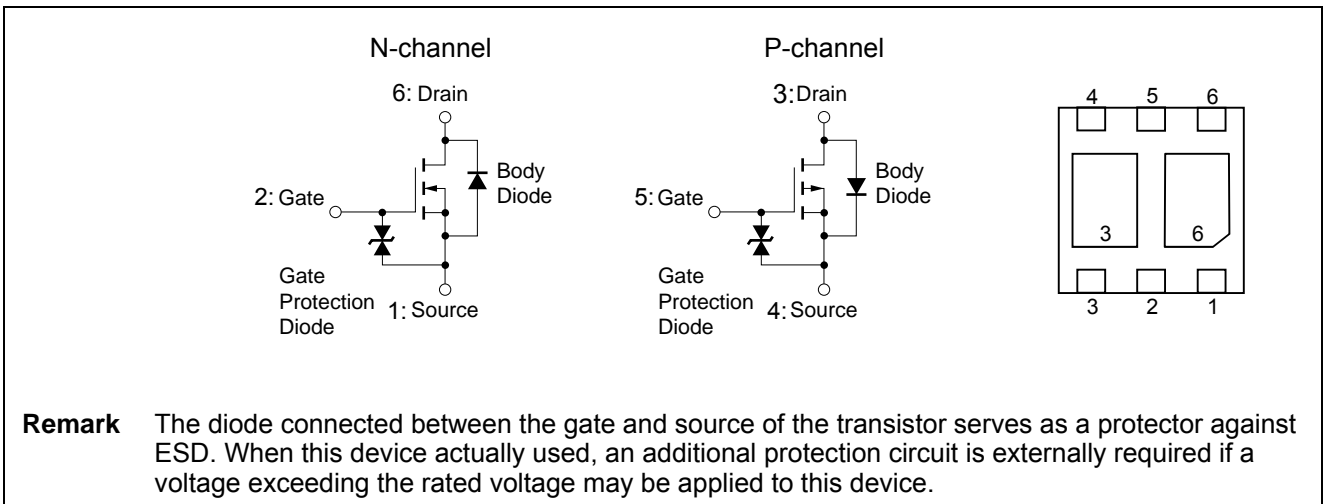


Package Drawings (Unit: mm)

6pinHUSON2020(DUAL)



Equivalent Circuit / Pin Assignment



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