APM4052DU4C-TRL-VB Datasheet

N- and P-Channel 40 V (D-S) MOSFET

PRODUCT SUMMARY		
	N-CHANNEL	P-CHANNEL
V_{DS} (V)	40	- 40
$R_{DS(on)}$ (Ω) at V_{GS} = ± 10 V	0.014	0.014
$R_{DS(on)}$ (Ω) at V_{GS} = ± 4.5 V	0.016	0.016
I_D (A)	50	- 50
Configuration	N- and P-Pair	

FEATURES

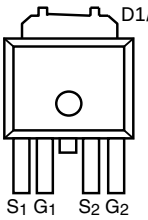
- Trench Power MOSFET
- 100 % R_g and UIS Tested

APPLICATIONS

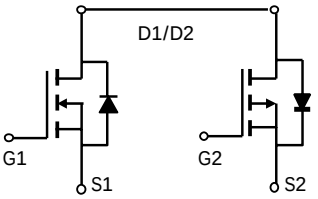
- CCFL Inverter

Pb-free
RoHS COMPLIANT
HALOGEN FREE

TO-252-4L
D-PAK



Top View
Drain Connected to Tab



N-channel P-channel

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)					
PARAMETER		SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Drain-Source Voltage		V_{DS}	40	- 40	V
Gate-Source Voltage		V_{GS}	± 20		
Continuous Drain Current[a]	T_C = 25 °C	I_D	50	-50	A
	T_C = 125 °C		35	-35	
Continuous Source Current (Diode Conduction)[a]		I_S	50	-50	
Pulsed Drain Current[b]		I_{DM}	150	-150	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	30	- 30	
Single Pulse Avalanche Energy		E_{AS}	245	245	mJ
Maximum Power Dissipation[b]	T_C = 25 °C	P_D	108	108	W
	T_C = 125 °C		32	32	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to + 175		°C
Soldering Recommendations (Peak Temperature)			260		

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Junction-to-Ambient	PCB Mount[c]	R_{thJA}	85	85	°C/W
Junction-to-Case (Drain)		R_{thJC}	3.1	3.1	

Notes

a. Package limited.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
c. When mounted on 1" square PCB (FR4 material).
d. Parametric verification ongoing.

SPECIFICATIONS (T_C = 25 °C, unless otherwise noted)								
PARAMETER	**SYMBOL**	**TEST CONDITIONS**			**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static								
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA		N-Ch	40	-	-	V
		V_{GS} = 0 V, I_D = - 250 µA		P-Ch	- 40	-	-	
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA		N-Ch	1.0	-	3.0	
		V_{DS} = V_{GS}, I_D = - 250 µA		P-Ch	- 1.0	-	-3.0	
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V		N-Ch	-	-	± 100	nA
				P-Ch	-	-	± 100	
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V	V_{DS} = 40 V	N-Ch	-	-	1	µA
		V_{GS} = 0 V	V_{DS} = - 40 V	P-Ch	-	-	- 1	
		V_{GS} = 0 V	V_{DS} = 40 V, T_J = 125 °C	N-Ch	-	-	50	
		V_{GS} = 0 V	V_{DS} = - 40 V, T_J = 125 °C	P-Ch	-	-	- 50	
		V_{GS} = 0 V	V_{DS} = 40 V, T_J = 175 °C	N-Ch	-	-	150	
		V_{GS} = 0 V	V_{DS} = - 40 V, T_J = 175 °C	P-Ch	-	-	- 150	
On-State Drain Current[a]	$I_{D(on)}$	V_{GS} = 10 V	V_{DS} ≥ 5 V	N-Ch	25	-	-	A
		V_{GS} = - 10 V	V_{DS} ≤ 5 V	P-Ch	- 25	-	-	
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 38 A	N-Ch	-	0.014	-	Ω
		V_{GS} = - 10 V	I_D = - 38 A	P-Ch	-	0.014	-	
		V_{GS} = 10 V	I_D = 38 A, T_J = 125 °C	N-Ch	-	0.017	-	
		V_{GS} = - 10 V	I_D = - 38 A, T_J = 125 °C	P-Ch	-	0.017	-	
		V_{GS} = 10 V	I_D = 38 A, T_J = 175 °C	N-Ch	-	0.025	-	
		V_{GS} = - 10 V	I_D = - 38 A, T_J = 175 °C	P-Ch	-	0.025	-	
		V_{GS} = 4.5 V	I_D = 30 A	N-Ch	-	0.016	-	
		V_{GS} = - 4.5 V	I_D = - 30A	P-Ch	-	0.016	-	
Forward Transconductance[b]	g_{fs}	V_{DS} = 15 V, I_D = 38 A		N-Ch	-	40	-	S
		V_{DS} = - 15 V, I_D = - 38 A		P-Ch	-	18	-	
Dynamic[b]								
Input Capacitance	C_{iss}	V_{GS} = 0 V	V_{DS} = 20 V, f = 1 MHz	N-Ch	-	1799	2248	pF
		V_{GS} = 0 V	V_{DS} = - 20 V, f = 1 MHz	P-Ch	-	2000	3500	
Output Capacitance	C_{oss}	V_{GS} = 0 V	V_{DS} = 20 V, f = 1 MHz	N-Ch	-	282	352	
		V_{GS} = 0 V	V_{DS} = - 20 V, f = 1 MHz	P-Ch	-	320	550	
Reverse Transfer Capacitance	C_{rss}	V_{GS} = 0 V	V_{DS} = 20 V, f = 1 MHz	N-Ch	-	109	136	
		V_{GS} = 0 V	V_{DS} = - 20 V, f = 1 MHz	P-Ch	-	220	360	
Total Gate Charge[c]	Q_g	V_{GS} = 10 V	V_{DS} = 20 V, I_D = 10 A	N-Ch	-	310	-	nC
		V_{GS} = - 10 V	V_{DS} = - 20 V, I_D = - 10 A	P-Ch	-	420	-	
Gate-Source Charge[c]	Q_{gs}	V_{GS} = 10 V	V_{DS} = 20 V, I_D = 10 A	N-Ch	-	5.7	-	
		V_{GS} = - 10 V	V_{DS} = - 20 V, I_D = - 10 A	P-Ch	-	5.5	-	
Gate-Drain Charge[c]	Q_{gd}	V_{GS} = 10 V	V_{DS} = 20 V, I_D = 10 A	N-Ch	-	4.8	-	
		V_{GS} = - 10 V	V_{DS} = - 20 V, I_D = - 10 A	P-Ch	-	10.5	-	
Gate Resistance	R_g	f = 1 MHz		N-Ch	2	4.11	6.2	Ω
				P-Ch	3.1	6.3	9.5	

Notes

a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

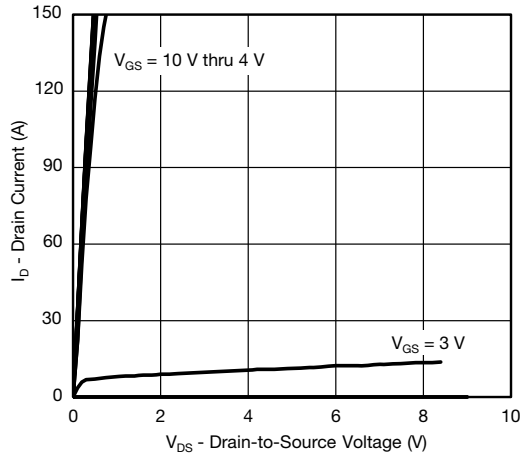
SPECIFICATIONS (T_C = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Turn-On Delay Time[c]	$t_{d(on)}$	V_{DD} = 20 V, R_L = 2 Ω $I_D \cong$ 10 A, V_{GEN} = 10 V, R_g = 1 Ω	N-Ch	-	7	11	ns
		V_{DD} = - 20 V, R_L = 2 Ω $I_D \cong$ - 10 A, V_{GEN} = - 10 V, R_g = 1 Ω	P-Ch	-	11	17	
Rise Time[c]	t_r	V_{DD} = 20 V, R_L = 2 Ω $I_D \cong$ 10 A, V_{GEN} = 10 V, R_g = 1 Ω	N-Ch	-	21	32	
		V_{DD} = - 20 V, R_L = 2 Ω $I_D \cong$ - 10 A, V_{GEN} = - 10 V, R_g = 1 Ω	P-Ch	-	9	14	
Turn-Off Delay Time[c]	$t_{d(off)}$	V_{DD} = 20 V, R_L = 2 Ω $I_D \cong$ 10 A, V_{GEN} = 10 V, R_g = 1 Ω	N-Ch	-	33	50	
		V_{DD} = - 20 V, R_L = 2 Ω $I_D \cong$ - 10 A, V_{GEN} = - 10 V, R_g = 1 Ω	P-Ch	-	55	83	
Fall Time[c]	t_f	V_{DD} = 20 V, R_L = 2 Ω $I_D \cong$ 10 A, V_{GEN} = 10 V, R_g = 1 Ω	N-Ch	-	19	29	
		V_{DD} = - 20 V, R_L = 2 Ω $I_D \cong$ - 10 A, V_{GEN} = - 10 V, R_g = 1 Ω	P-Ch	-	91	137	
Source-Drain Diode Ratings and Characteristics[b]							
Pulsed Current[a]	I_{SM}		N-Ch	-	-	32	A
			P-Ch	-	-	- 32	
Forward Voltage	V_{SD}	I_S = 4 A	N-Ch	-	0.79	1.2	V
		I_S = - 4 A	P-Ch	-	- 0.82	- 1.2	

Notes

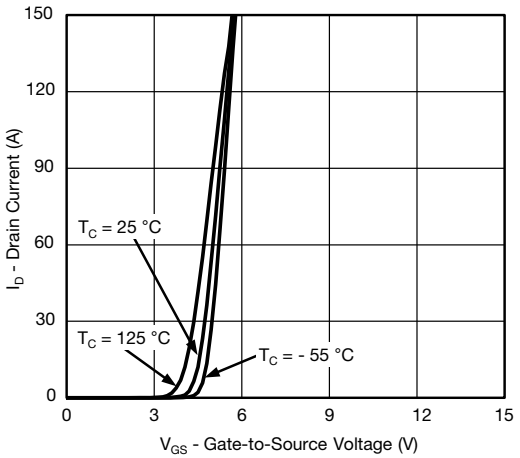
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

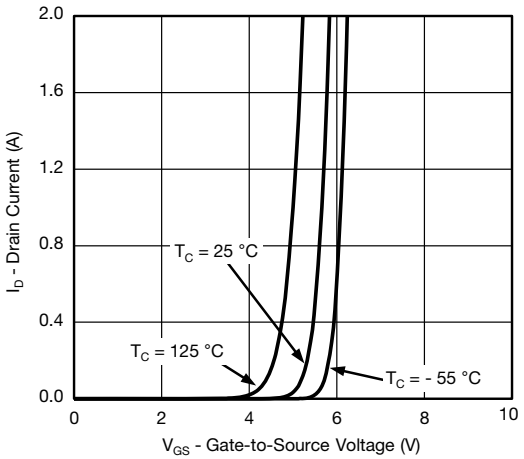
N-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



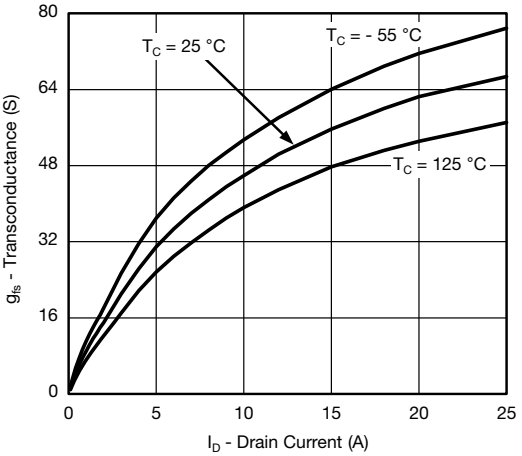
Output Characteristics



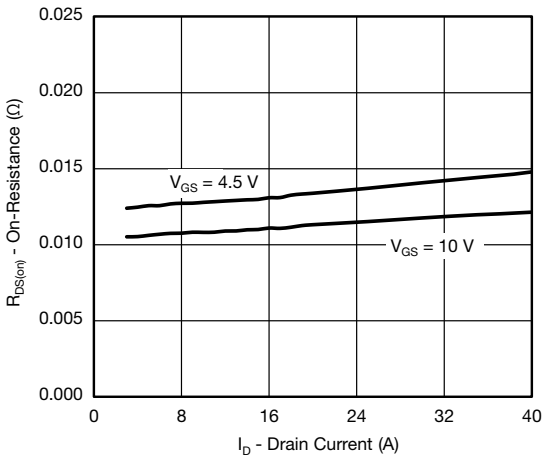
Transfer Characteristics



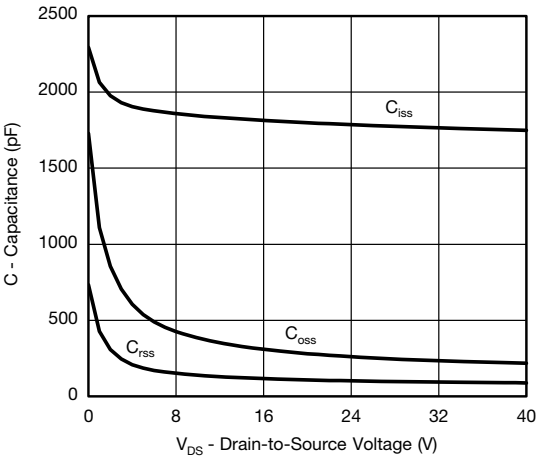
Transfer Characteristics



Transconductance

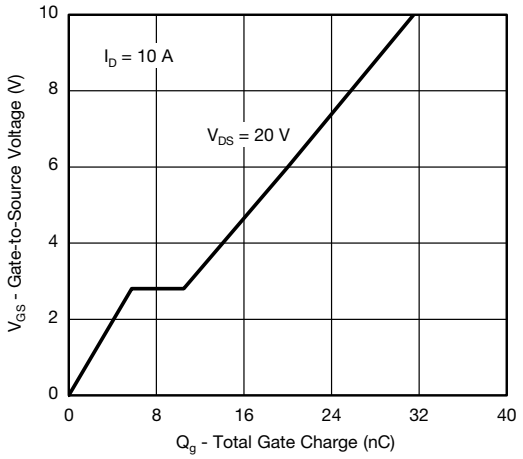


On-Resistance vs. Drain Current

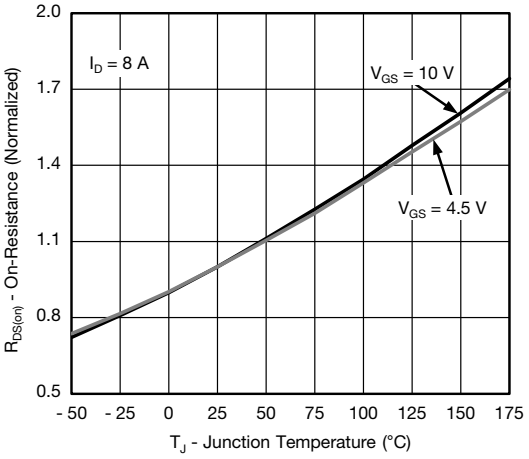


Capacitance

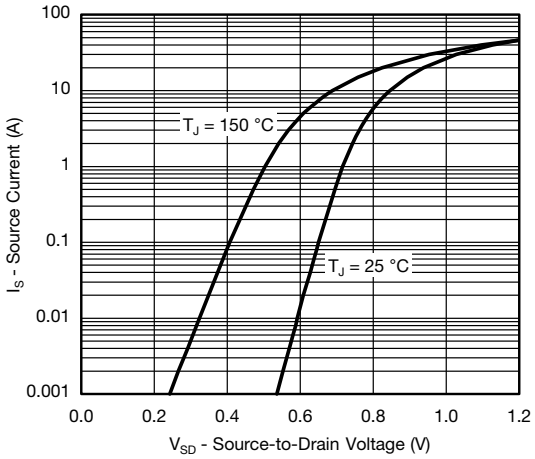
N-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



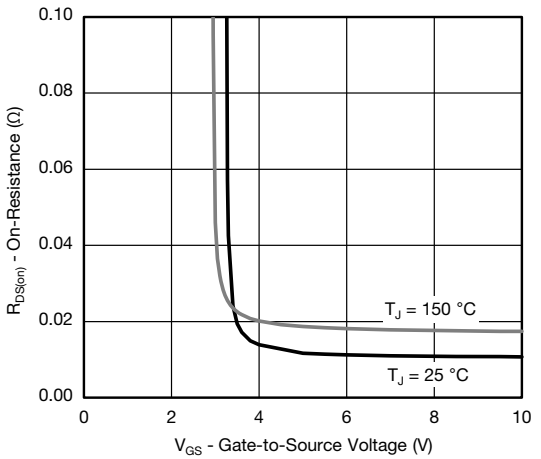
Gate Charge



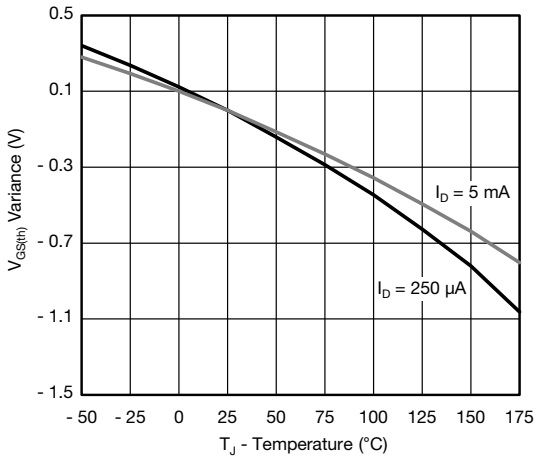
On-Resistance vs. Junction Temperature



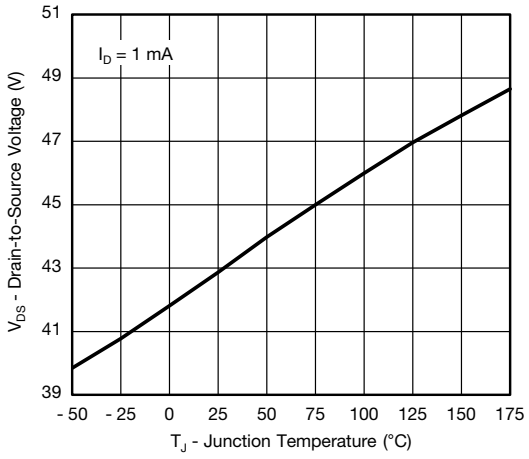
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage

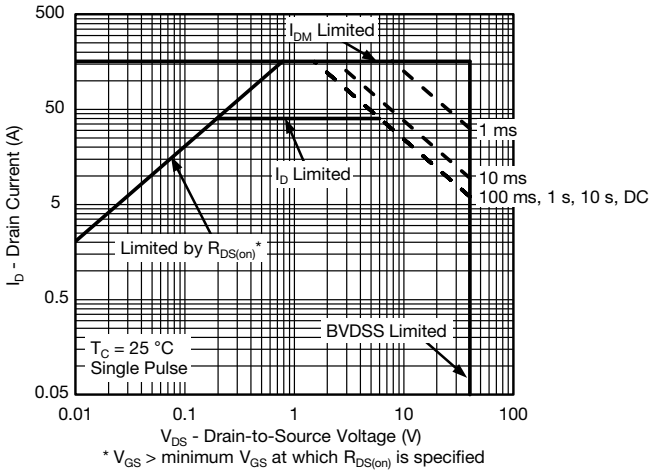


Threshold Voltage

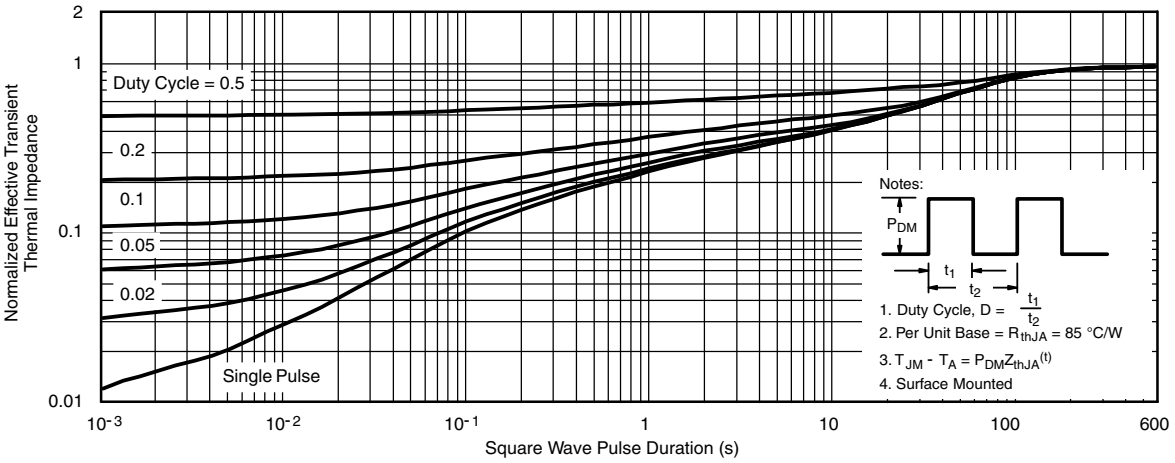


Drain Source Breakdown vs. Junction Temperature

N-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)

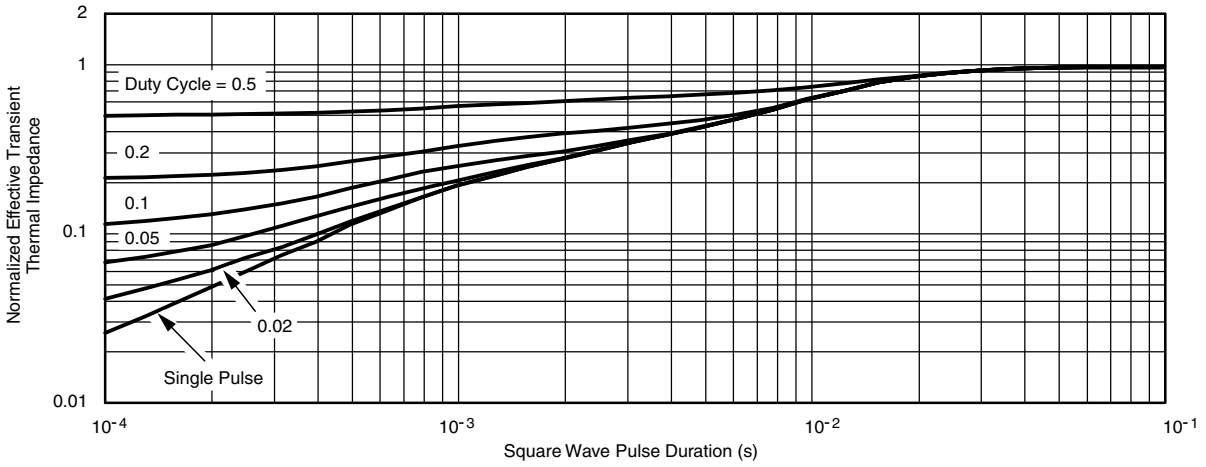


Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Ambient

N-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



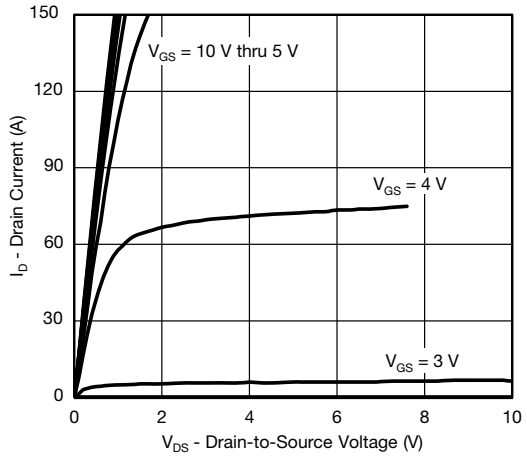
Normalized Thermal Transient Impedance, Junction-to-Case

Note

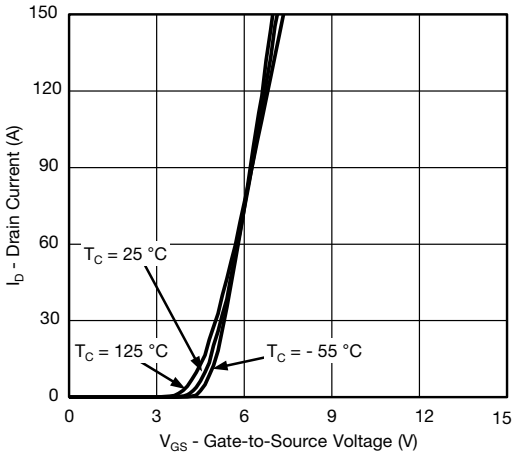
- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Case (25 °C)

  are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

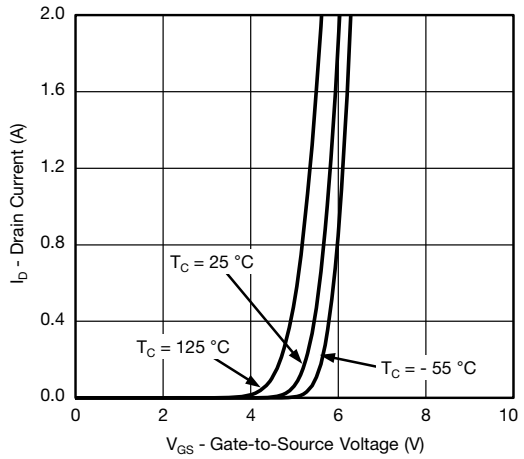
P-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



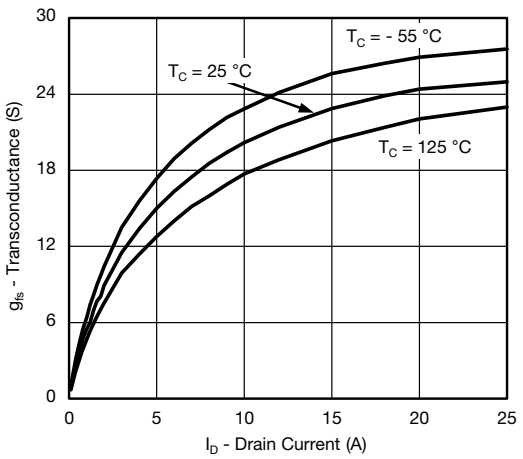
Output Characteristics



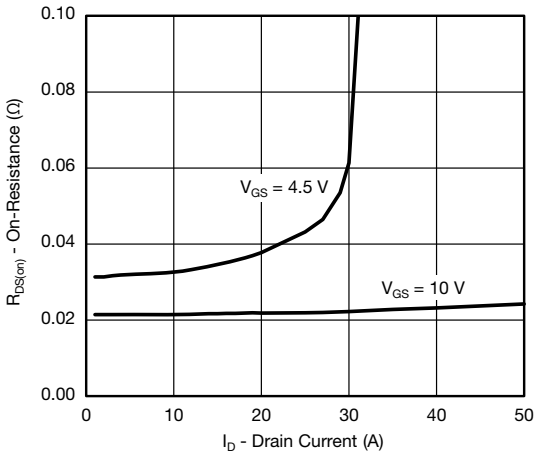
Transfer Characteristics



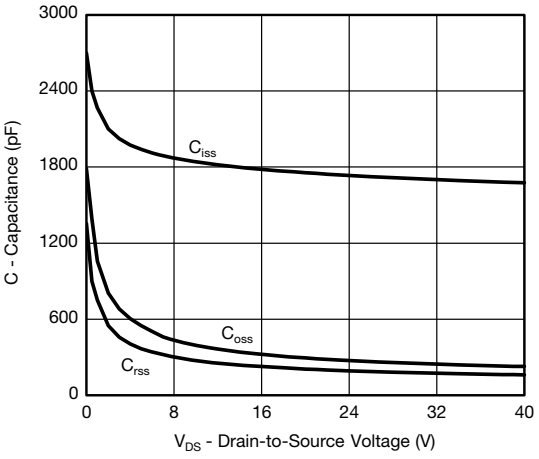
Transfer Characteristics



Transconductance

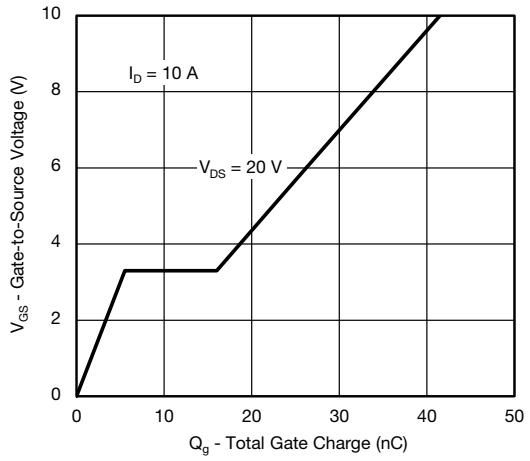


On-Resistance vs. Drain Current

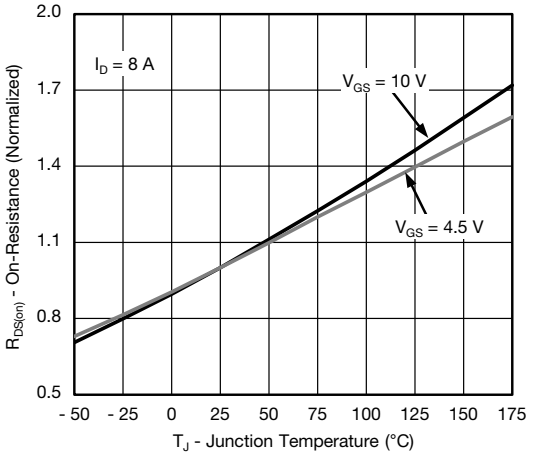


Capacitance

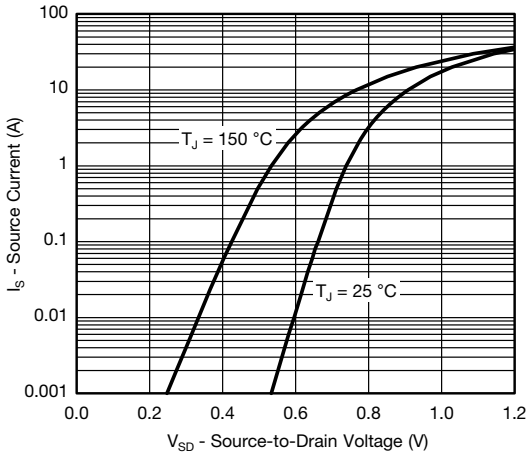
P-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



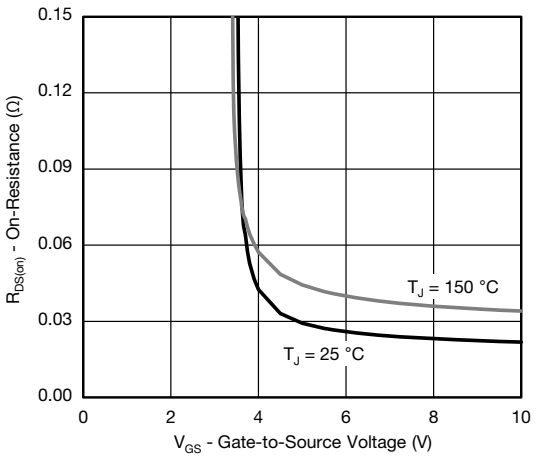
Gate Charge



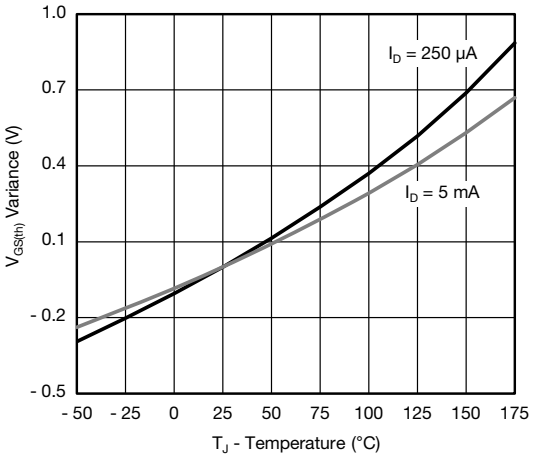
On-Resistance vs. Junction Temperature



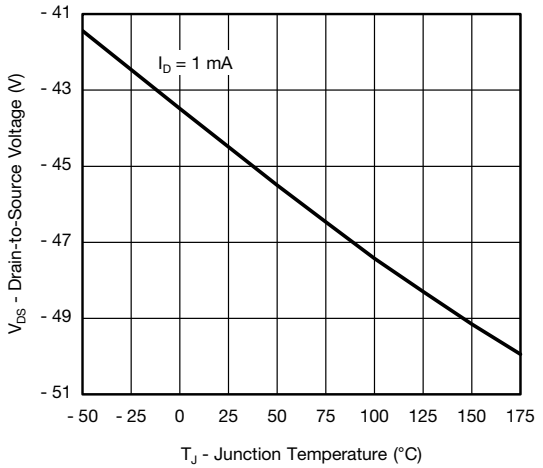
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage

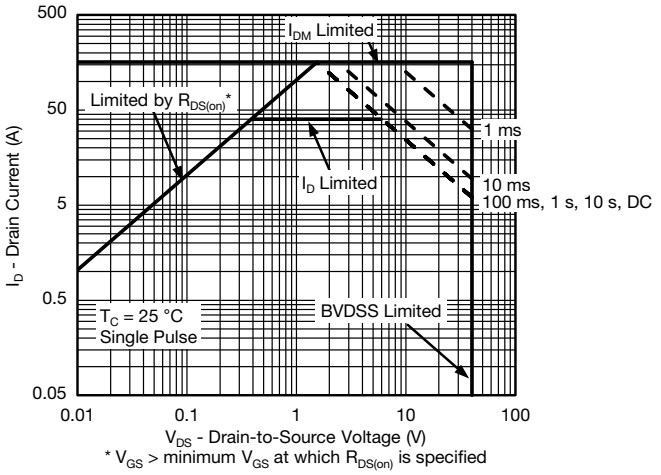


Threshold Voltage

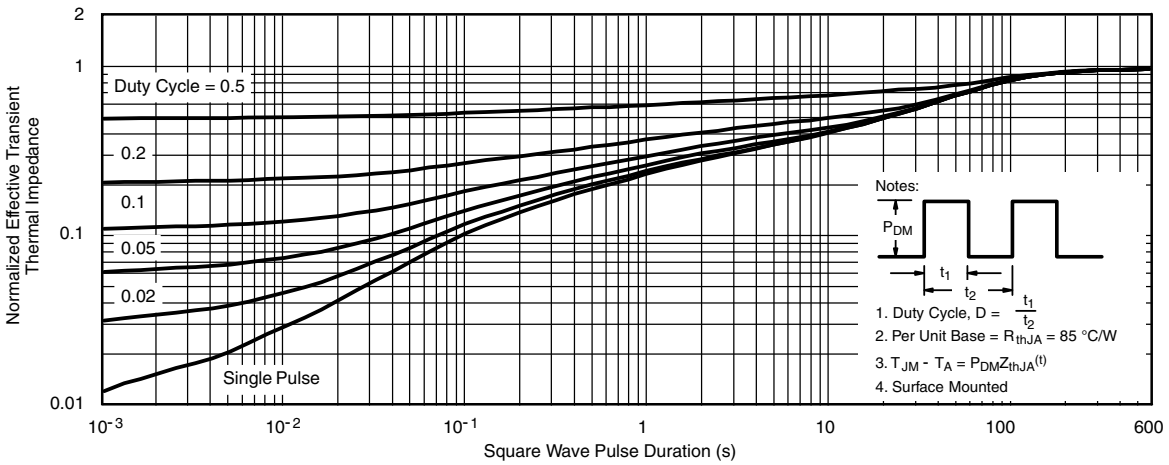


Drain Source Breakdown vs. Junction Temperature

P-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)

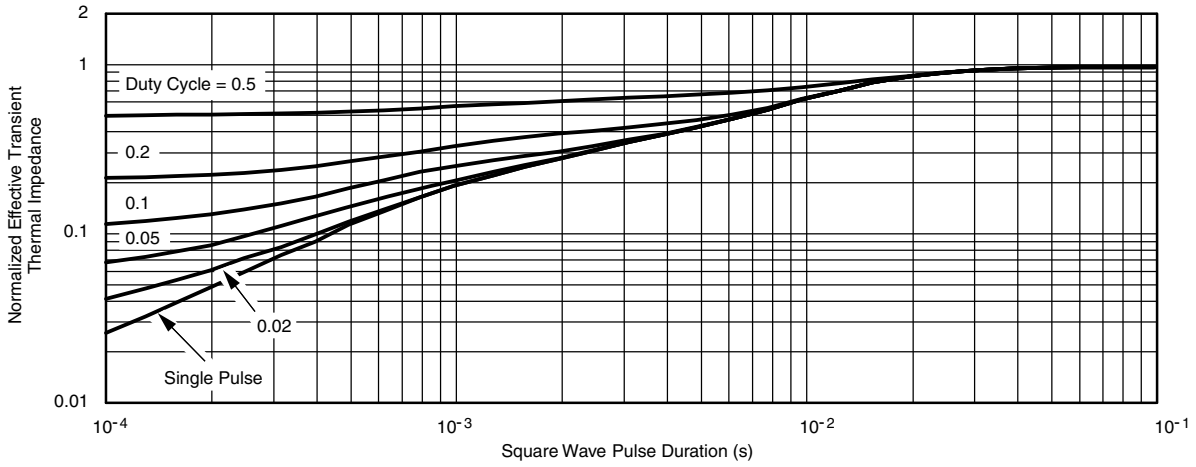


Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Ambient

P-CHANNEL TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Case

Note

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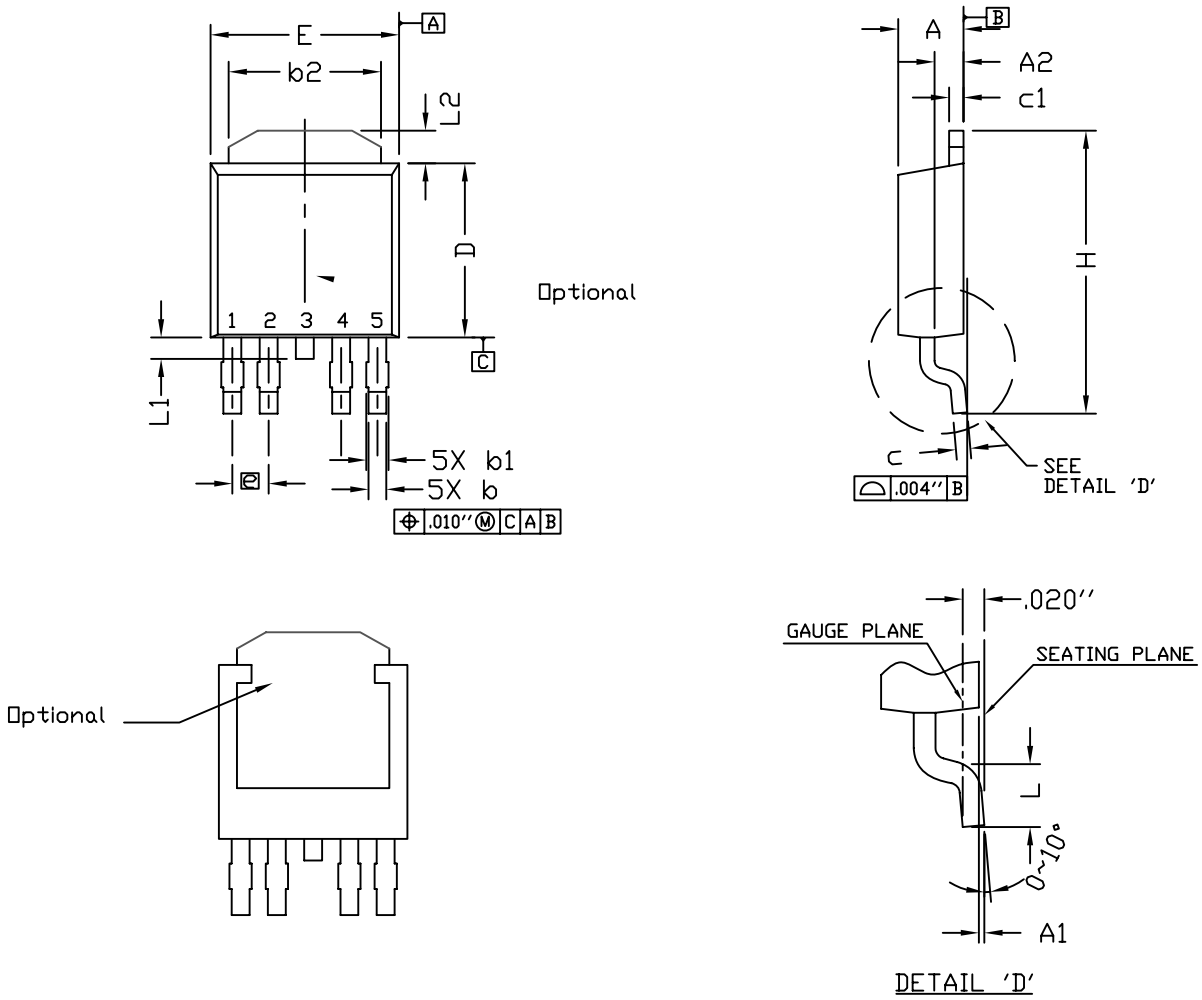
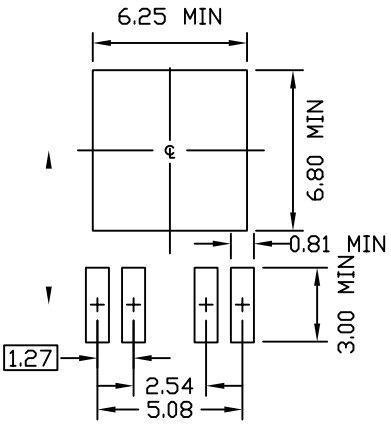
  are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

TO-252_4L Package Outline



RECOMMENDED LAND PATTERN



UNIT: mm

SYMBOL	DIMENSION IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	2.184	2.286	2.388	0.086	0.090	0.094
A1	0.000	-----	0.127	0.000	-----	0.005
A2	0.889	-----	1.143	0.035	-----	0.045
b	0.508	-----	0.711	0.020	-----	0.028
b1	0.584	-----	0.787	0.023	-----	0.031
b2	4.953	-----	5.461	0.195	-----	0.215
c	0.457	0.508	0.610	0.018	0.020	0.024
c1	0.457	-----	0.610	0.018	-----	0.024
D	5.969	6.096	6.223	0.235	0.240	0.245
E	6.350	6.604	6.731	0.250	0.260	0.265
e	1.270 BSC.			0.050 BSC.		
H	9.398	-----	10.414	0.370	-----	0.410
L	1.270	-----	2.032	0.050	-----	0.080
L1	-----	-----	1.016	-----	-----	0.040
L2	0.889	-----	1.270	0.035	-----	0.050

NOTE
1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS. MOLD FLASH SHOULD BE LESS THAN 6 MIL.
2. DIMENSION L IS MEASURED IN GAUGE PLANE.
3. TOLERANCE 0.10 mm UNLESS OTHERWISE SPECIFIED.
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. REFER TO JEDEC TO-252 (AD).

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