

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (U-MOS VI)

# TPCA8128

Lithium Ion Battery Applications  
Power Management Switch Applications

- Small footprint due to compact and slim package
- Low drain-source ON resistance :  $R_{DS(ON)} = 3.7 \text{ m}\Omega$  (typ.)
- Low leakage current :  $I_{DSS} = -10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = -30 \text{ V}$ )
- Enhancement mode  
:  $V_{th} = -0.8 \text{ to } -2.0 \text{ V}$  ( $V_{DS} = -10 \text{ V}$ ,  $I_D = -0.5 \text{ mA}$ )

## Absolute Maximum Ratings (Ta = 25°C)

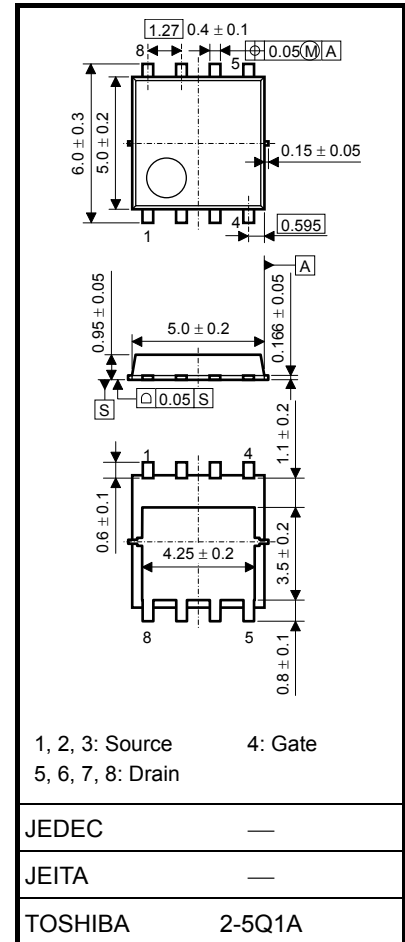
Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	-30	V
Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )		$V_{DGR}$	-30	V
Gate-source voltage		$V_{GSS}$	-25/+20	V
Drain current	DC (Note 1)	$I_D$	-34	A
	Pulse (Note 1)	$I_{DP}$	-102	
Drain power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	45	W
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2a)		$P_D$	2.8	
Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)		$P_D$	1.6	
Single pulse avalanche energy (Note 3)		$E_{AS}$	150	mJ
Avalanche current		$I_{AR}$	-34	A
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°C

Note: For (Note 1), (Note 2), (Note 3), refer to the next page.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

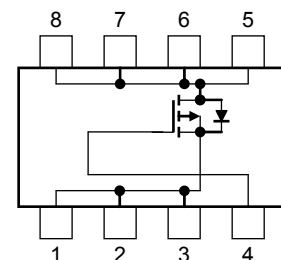
This transistor is an electrostatic-sensitive device. Handle with caution.

Unit: mm



Weight: 0.076 g (typ.)

## Circuit Configuration

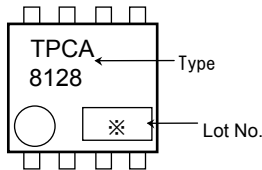


Start of commercial production  
2009-12

## Thermal Characteristics

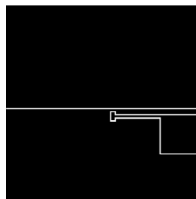
Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case ( $T_c = 25\text{ }^\circ\text{C}$ )	$R_{th(ch-c)}$	2.78	$^\circ\text{C/W}$
Thermal resistance, channel to ambient ( $t = 10\text{ s}$ ) (Note 2a)	$R_{th(ch-a)}$	44.6	$^\circ\text{C/W}$
Thermal resistance, channel to ambient ( $t = 10\text{ s}$ ) (Note 2b)	$R_{th(ch-a)}$	78.1	

## Marking (Note 4)



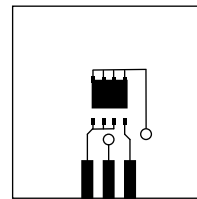
Note 1: The channel temperature should not exceed  $150^\circ\text{C}$  during use.

Note 2: (a) Device mounted on a glass-epoxy board (a)      (b) Device mounted on a glass-epoxy board (b)



(a)

FR-4  
 $25.4 \times 25.4 \times 0.8$   
 (Unit: mm)

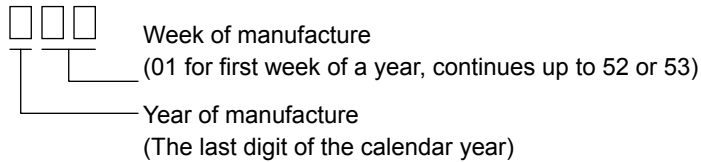


(b)

FR-4  
 $25.4 \times 25.4 \times 0.8$   
 (Unit: mm)

Note 3:  $V_{DD} = -24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 100\text{ }\mu\text{H}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AR} = -34\text{ A}$

Note 4: ※ Weekly code: (Three digits)



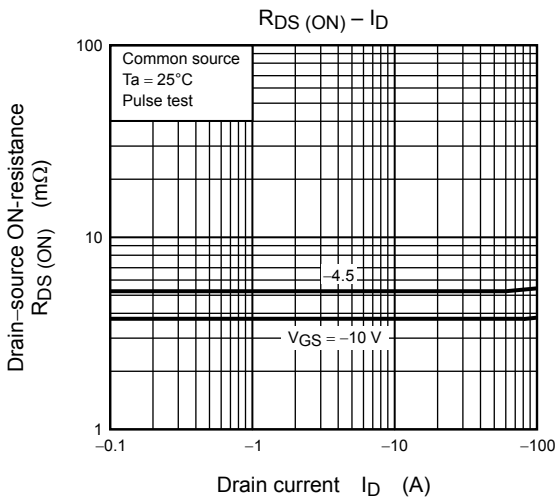
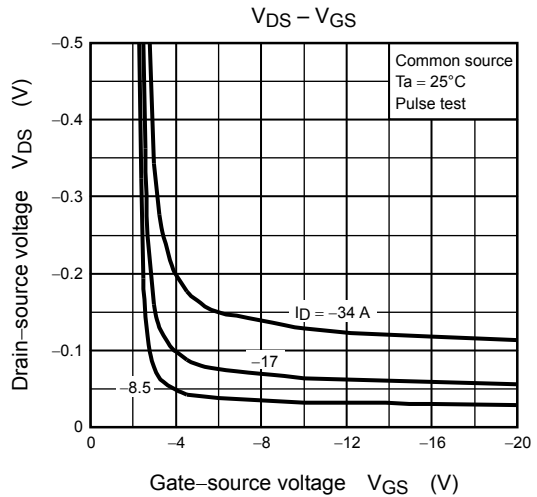
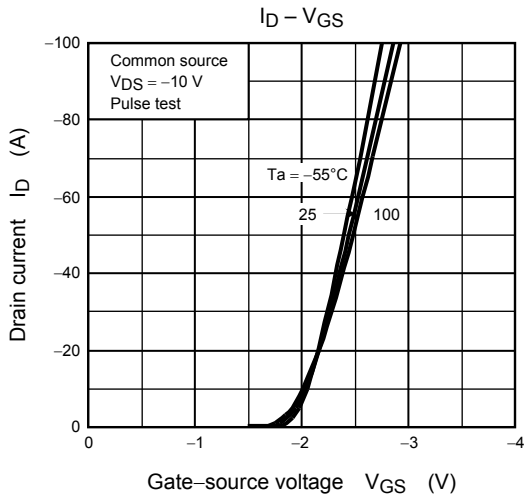
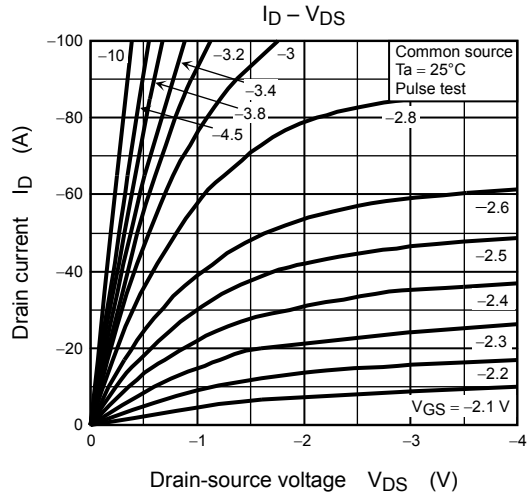
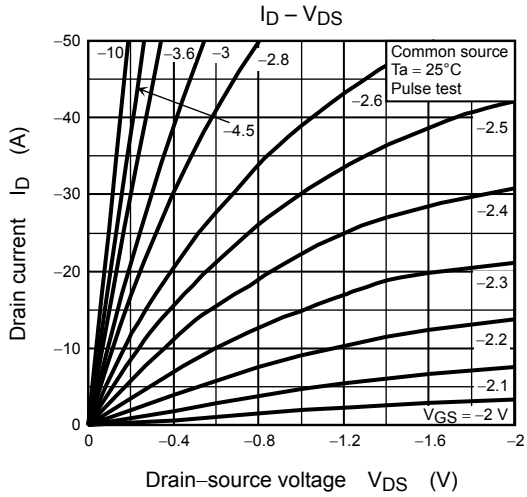
## Electrical Characteristics (Ta = 25°C)

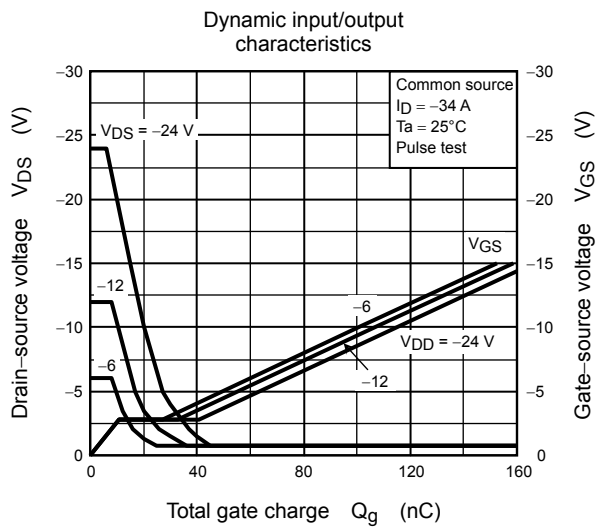
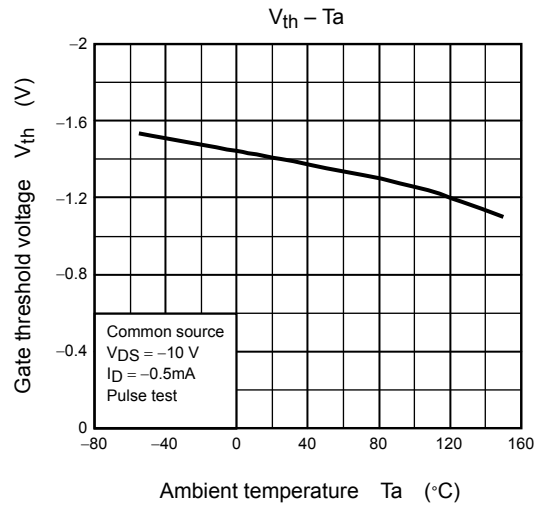
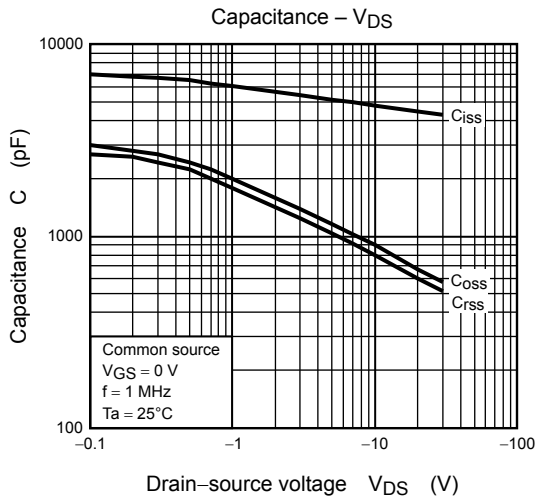
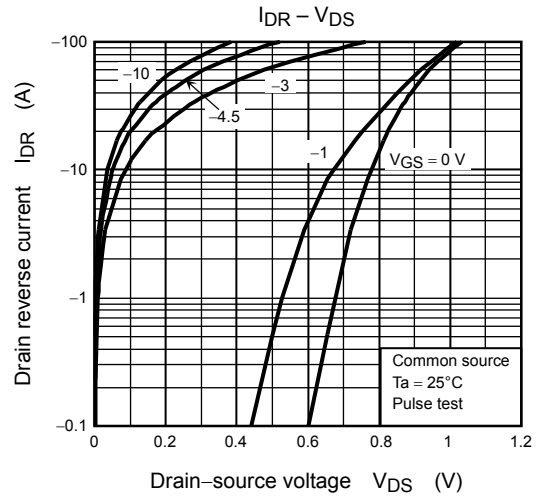
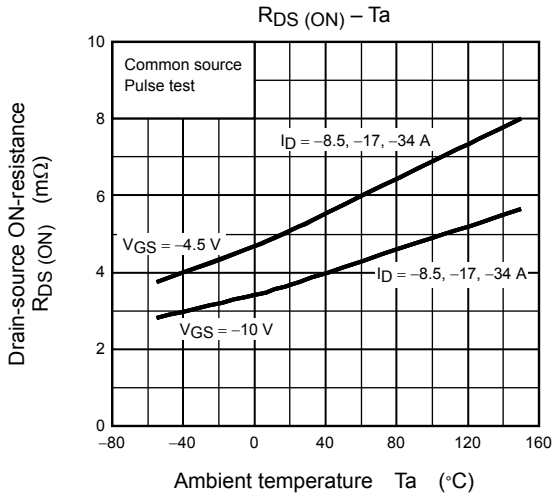
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 100$	nA
Drain cut-off current		$I_{DSS}$	$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$	—	—	-10	$\mu\text{A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$	-30	—	—	V
		$V_{(BR)DSX}$	$I_D = -10\text{ mA}, V_{GS} = 10\text{ V}$ (Note 5)	-21	—	—	
Gate threshold voltage		$V_{th}$	$V_{DS} = -10\text{ V}, I_D = -0.5\text{ mA}$	-0.8	—	-2.0	V
Drain-source ON resistance		$R_{DS(ON)}$	$V_{GS} = -4.5\text{ V}, I_D = -17\text{ A}$	—	5.1	6.7	m $\Omega$
			$V_{GS} = -10\text{ V}, I_D = -17\text{ A}$	—	3.7	4.8	
Input capacitance		$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	4800	—	pF
Reverse transfer capacitance		$C_{rss}$		—	800	—	
Output capacitance		$C_{oss}$		—	900	—	
Switching time	Rise time	$t_r$		—	11	—	ns
	Turn-on time	$t_{on}$		—	21	—	
	Fall time	$t_f$		—	135	—	
	Turn-off time	$t_{off}$		Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$	—	390	
Total gate charge (gate-source plus gate-drain)		$Q_g$	$V_{DD} \approx -24\text{ V}, V_{GS} = -10\text{ V}$ $I_D = -34\text{ A}$	—	115	—	nC
Gate-source charge 1		$Q_{gs1}$		—	11	—	
Gate-drain ("Miller") charge		$Q_{gd}$		—	30	—	

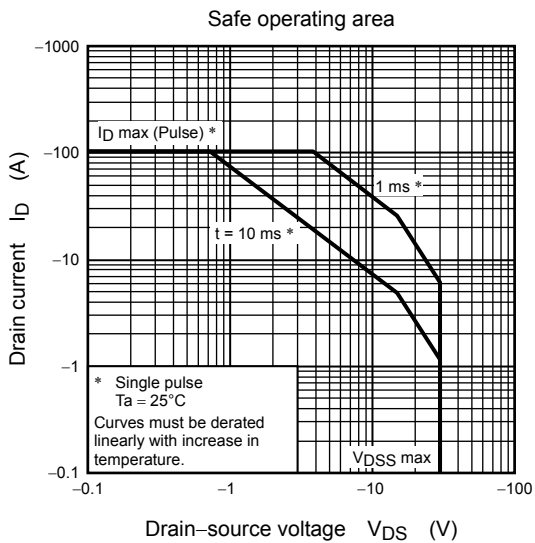
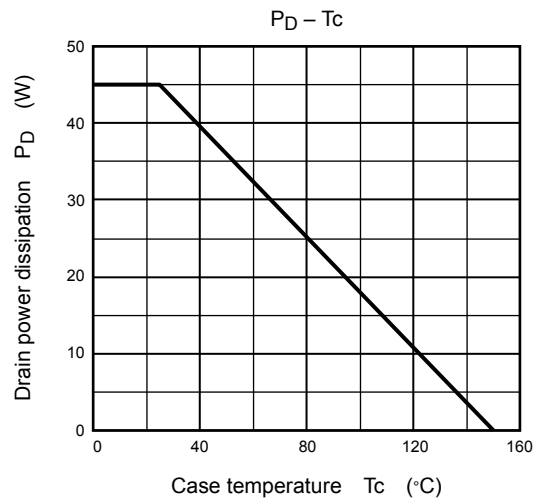
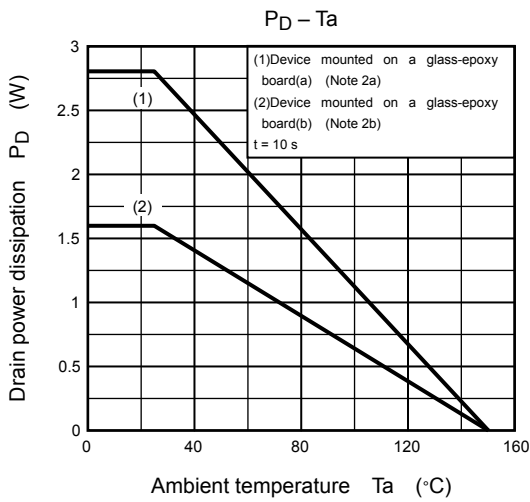
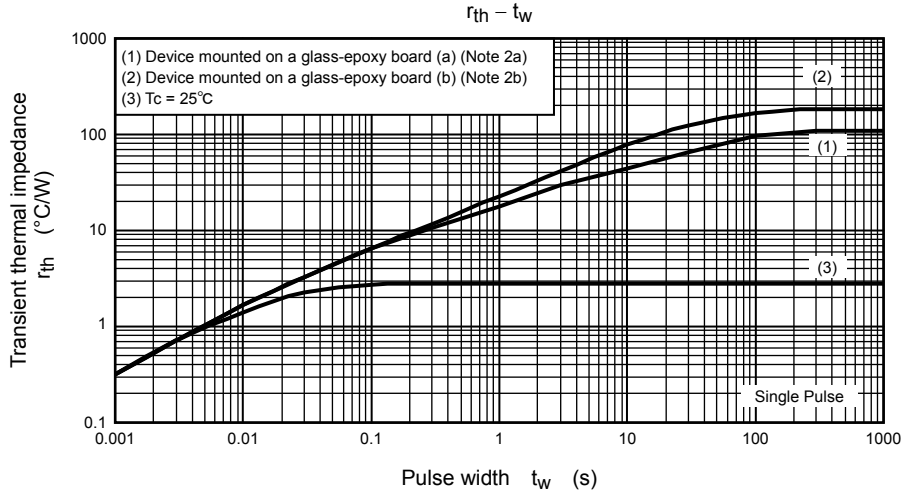
## Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	$I_{DRP}$	—	—	—	-102	A
Forward voltage (diode)		$V_{DSF}$	$I_{DR} = -34\text{ A}, V_{GS} = 0\text{ V}$	—	—	1.2	V

Note 5:  $V_{DSX}$  mode (the application of a plus voltage between gate and source) may cause decrease in maximum rating of drain-source voltage.







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