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AN6161

Turn-off Time, Leakage Current & Reverse Recovery Current Under Conditions Other than the Datasheet

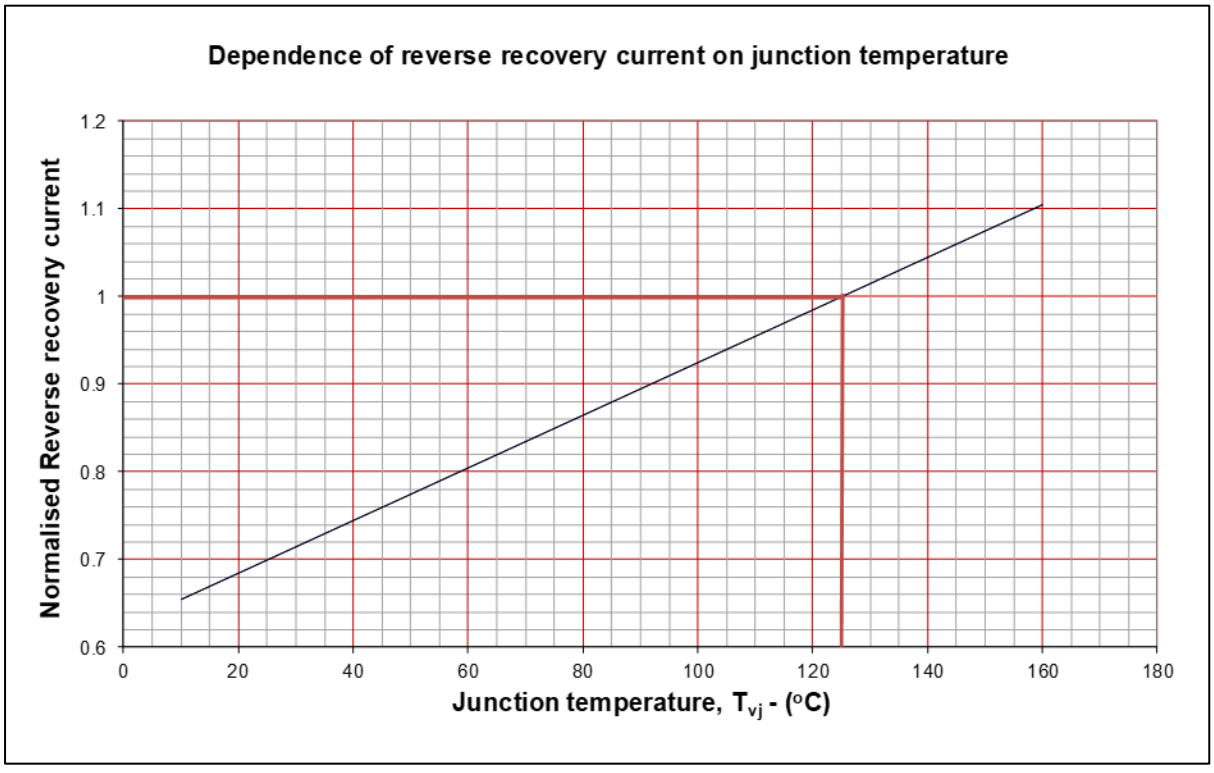
Application Note

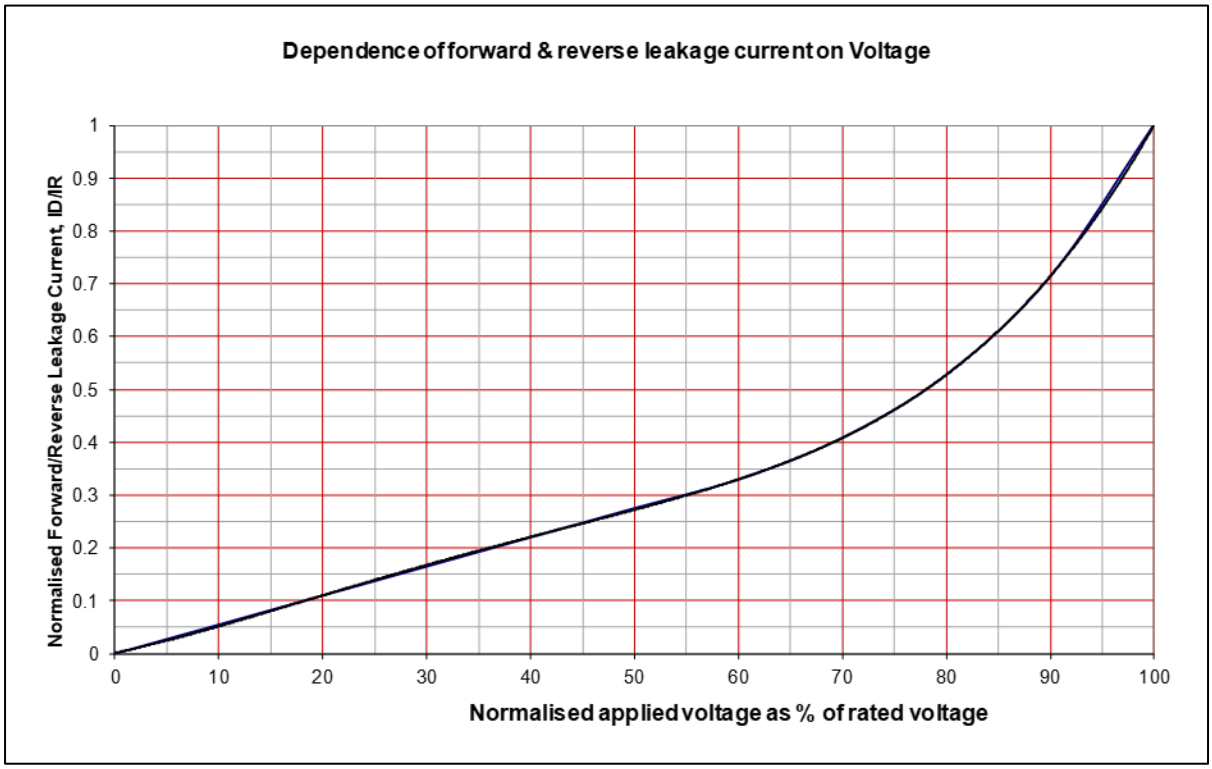
Replaces AN6161-1 AN6161-2 January 2023 (LN42363)

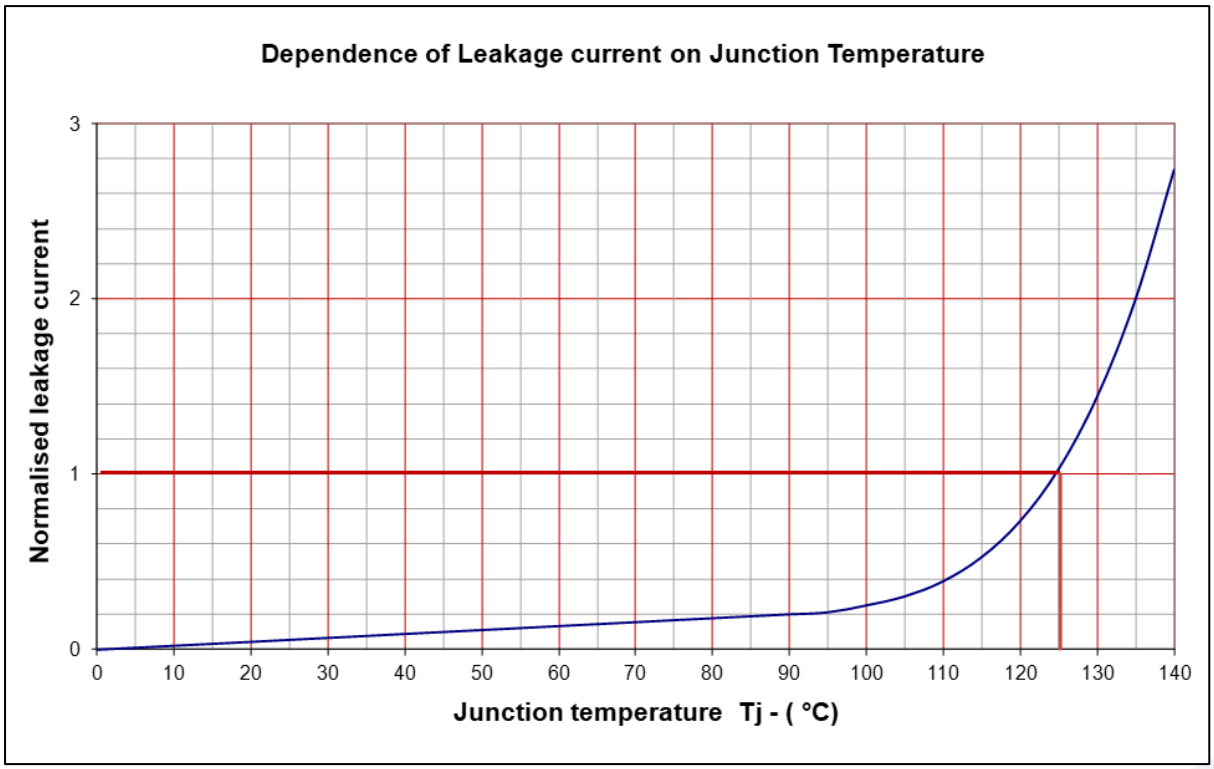
Introduction:

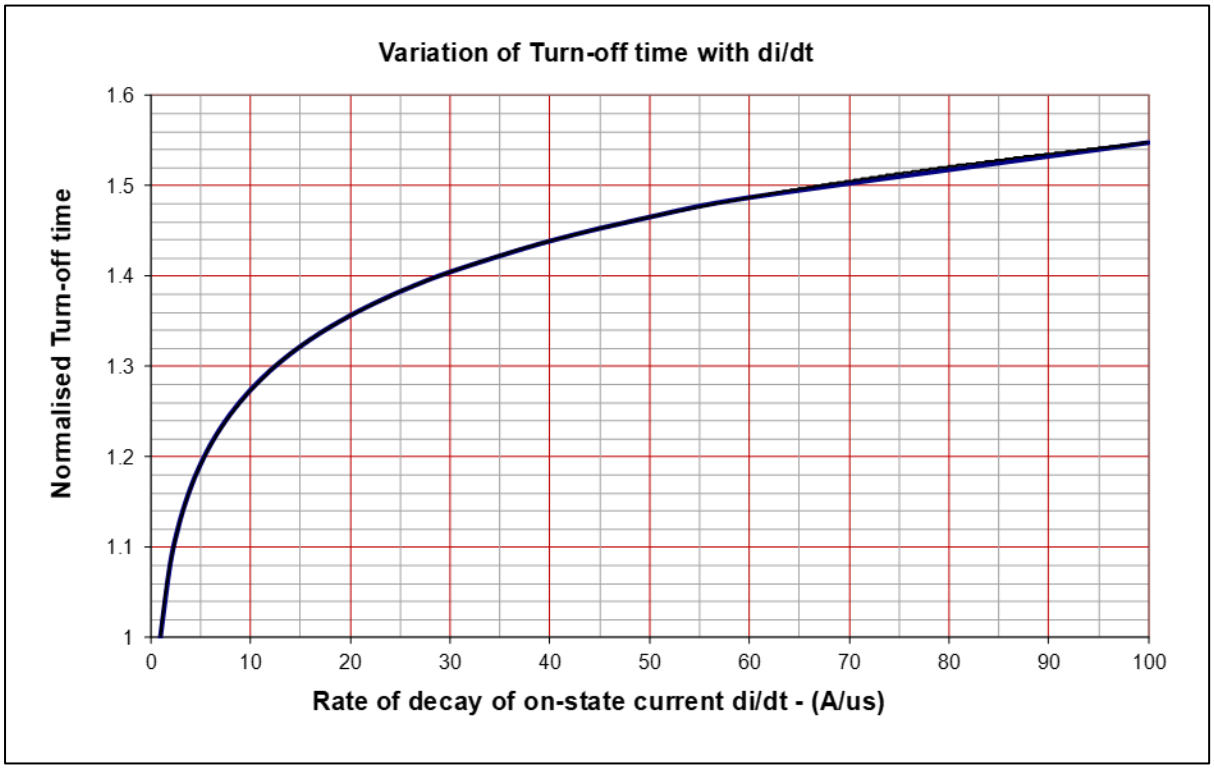
Datasheets tend to give device characteristics at a set of standard conditions. These characteristics are, however, dependent upon those conditions and if precise values are required under operating or test conditions then the factory should be consulted.

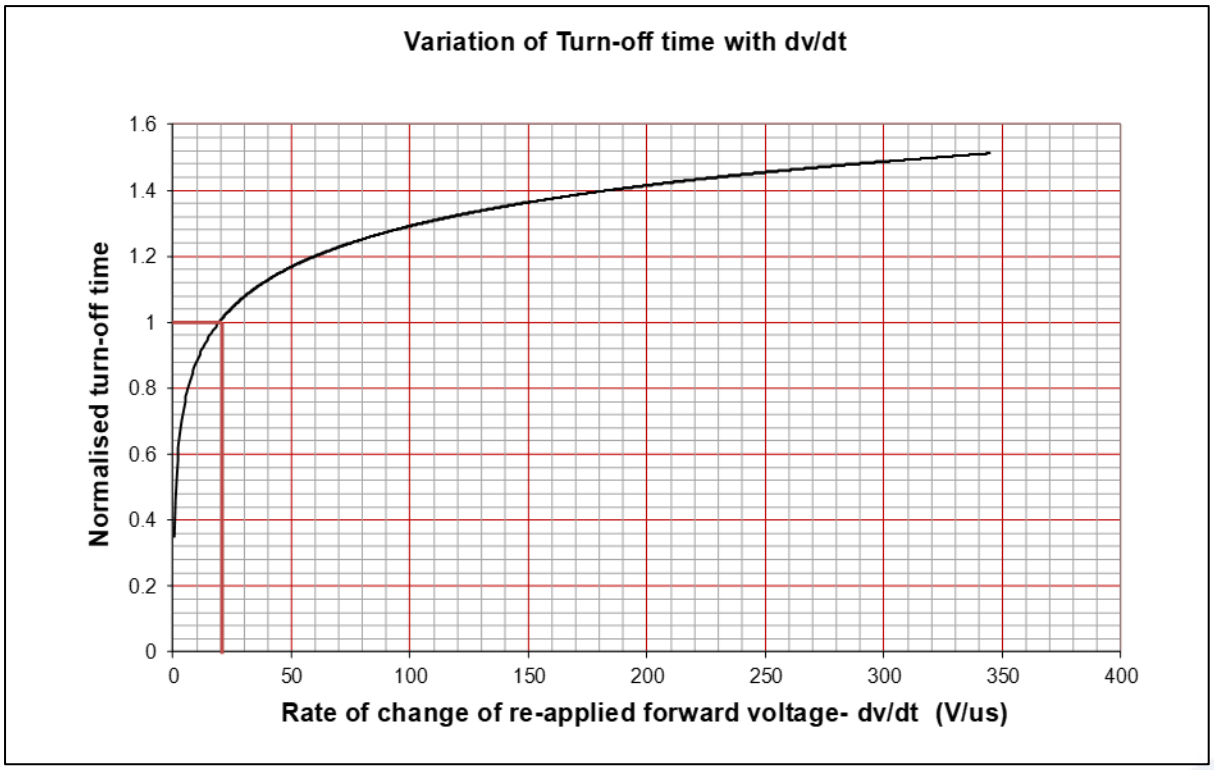
Several of these characteristics obey simple equations dependant on voltage and temperature such that values of the characteristics under different conditions can be estimated from normalised graphs such as those given below.

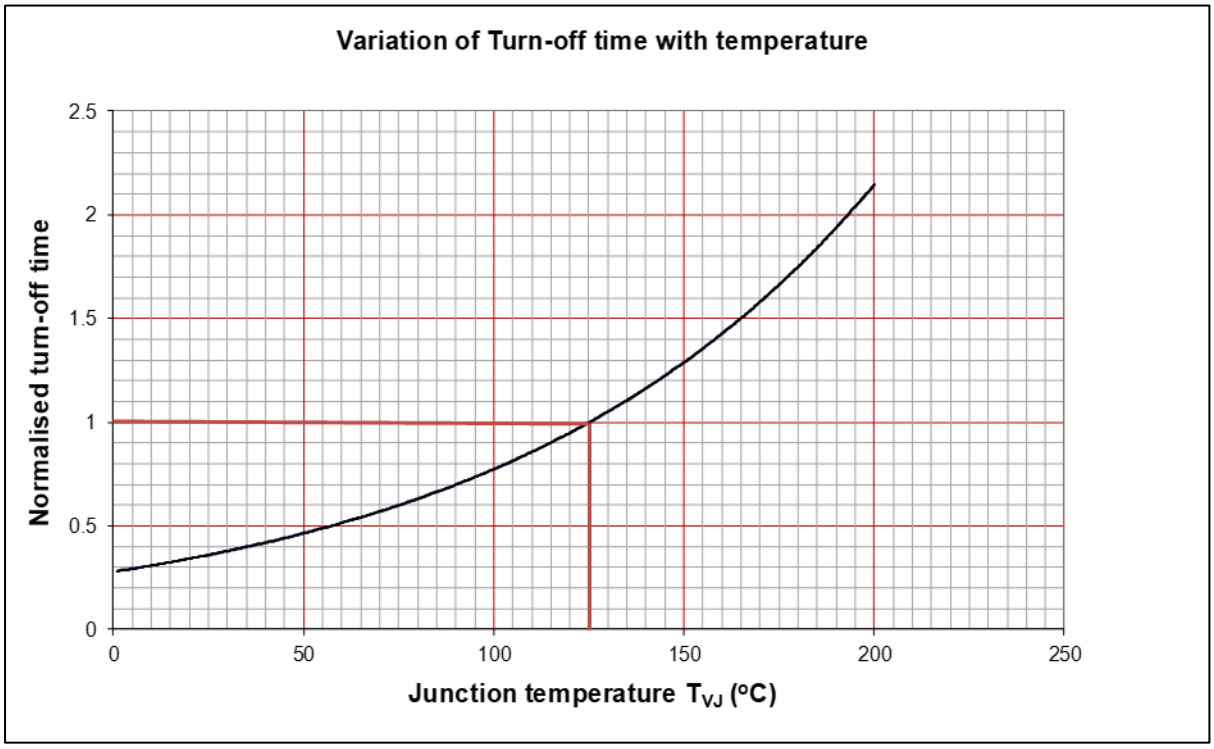



Dependence of forward & reverse leakage current on Voltage
Normalised Forward/Reverse Leakage Current, ID/IR
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
50
60
70
80
90
100
Normalised applied voltage as % of rated voltage


Dependence of Leakage current on Junction Temperature
Normalised leakage current
0
1
2
3
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
Junction temperature Tj - (°C)


Variation of Turn-off time with di/dt
Normalised Turn-off time
1.6
1.5
1.4
1.3
1.2
1.1
1
0
10
20
30
40
50
60
70
80
90
100
Rate of decay of on-state current di/dt - (A/us)


Variation of Turn-off time with dv/dt
Normalised turn-off time
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
300
350
400
Rate of change of re-applied forward voltage- dv/dt (V/us)



The graphs for the variation in turn-off time with temperature, re-applied voltage and di/dt can be combined into an EXCEL spreadsheet to estimate the turn-off time under conditions different to the datasheet conditions.

	A	B	C	D
1	**Datasheet conditions**			
2	data sheet t_q	200	µs	
3	di/dt	50	A/µs	= 0.0937*LN(B3) + 0.7874
4	dv/dt	20	V/µs	= 0.1780*LN(B4) + 0.4721
5	temperature	125	°C	= 0.2791*EXP(0.0102*B5)
6				
7	**Required conditions**			
8	di/dt	5	A/µs	= 0.0937*LN(B8) + 0.7874
9	dv/dt	20	V/µs	= 0.1780*LN(B9) + 0.4721
10	temperature	125	°C	= 0.2791*EXP(0.0102*B10)
11				
12	**Resultant t_q**	= B2*D8*D9*D10/(D3*D4*D5)	µs	

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